THE METAL INDUSTRY

WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER
ELECTRO-PLATERS REVIEW

Vol. 26 NEW YORK, SEPTEMBER, 1928 No. 9

An Old Plating Firm Takes Up Chromium

A Description of the Plant and Methods of Operation Used by the Tillmann Electro Plating Works, New York, in Electroplating Chromium and Other Standard Metal Finishes for the Trade

By MELVILLE TILLMANN
Assistant Treasurer, Tillmann Electro Plating Works

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

Chromium plating is the latest and in many ways the most outstanding development of the electroplating industry. It has captured the imagination of the general public and it has taken by storm the whole plating fraternity. Unlike many new developments, however, it has been undertaken not only by newcomers, but by those who have spent long years in plating and finishing work. Its soundness and evident practicability have been proved after thorough, and in many cases, expensive experimental work, so that now chromium plating is no longer on trial. It is an established process that hundreds and possibly thousands of platers and manufacturers are applying to commercial production work.

Concrete evidence of this condition is given by the Tillmann Electro Plating Works, Inc., of New York. This company is one of the oldest job plating firms in the Metropolitan District, having been established in 1860 by Julius Tillmann, Sr. He started in a very small way and operated the business, building it up to respectable proportions, until 1895, when he turned it over to his son, E. Tillmann, now president of the company. The Tillmann Works do a very large general electroplating business for the trade, consisting of jobbing work in nickel, copper, brass, silver and various oxidized finishes. In addition to their regular line of work, however, they have installed a chromium plating plant also for the trade, thus placing themselves abreast of the leaders in their industry. The class of work handled by this company includes automobile parts, marine work, lighting fixtures, hardware, plumbing supplies, novelties, etc.

FIG. 1—OFFICES OF THE TILLMANN WORKS

The Tillmann Electro Plating Works occupy three floors in the building in which they are located at 197 Grand Street, having a total of about 12,000 feet of floor space and over 100 employees. The officials of the company are E. Tillmann, president; Benson M. Katz, treasurer; Melville Tillmann, assistant treasurer; Julius Tillmann, secretary. An inactive vice-president is Lester Tillmann.

The raw material consists of parts made of iron, steel or other base materials, to be plated and finished. It is taken in by a receiving clerk who is a first-rate mechanic and a licensed engineer. His work is to disassemble all pieces which are joined, to mark them with a number or other designation by which they can be recognized and classified. Then the work is placed in a tote box and sent to the grinding and polishing room for preliminary polishing before plating. This tote box stays with the work throughout its entire trip through the plant.

Iron or steel parts are polished down with emery, first No. 80 and then No. 120. This is followed by a soft buffing in which the pieces are given a heavy cut down with polishing compound. Then the pieces are washed to remove the grease, dried and color-buffed. The pieces are then cleaned in a strong alkaline cleaner, washed in water and sent to the nickel plating room. They are placed in the still nickel tank and given a heavy plate, from 60 to 90 minutes. The important feature of this operation is

the fact that the plate must be of special character, very soft, in order to be suitable for subsequent chromium plating. A special solution is used for this purpose.

After plating, the work is rinsed in water, dried, put

FIG. 2—A CORNER OF THE CHROMIUM ROOM

back into the original tote box and sent to the buffing room. It is buffed upon a soft rag wheel, colored up and wiped. It is then dipped into an alkaline cleaner, washed in water and then placed in the chromium plating solution, where it remains for 30 minutes or more, depending upon the weight of the plate desired. The work is then taken from the tanks, washed with cold and hot water, dried and given a final polish with green crocus, after which it is ready for re-assembling if necessary, packing and shipping, which is, of course, in the hands iof a special shipping clerk.

On some special types of steel articles, this routine may

FIG. 3—POLISHERS AT WORK

have to be varied a little, the following being an example:

Copper plate and buff to a high polish.

Nickel plate and buff to a high polish.

Chromium plate and buff to a high polish.

Between these various steps are, of course, the usual cleaning, washing and drying operations which are standard.

The receiving and shipping room of the Tillmann Works is on the sixth floor, employing two special clerks, one for receiving and one for shipping. After the incoming work has been receipted for, it is sent to the seventh floor for grinding, buffing and nickeling. This preliminary grinding and buffing department has twelve grinding lathes and eighteen buffing lathes, all double spindle, of the ball bearing type.

In the general plating room are four electric cleaning tanks with a capacity of about 300 to 400 gallons each. There are seven nickel tanks totalling 10,000 gallons; one copper tank, 1,000 gallons; one silver tank 500 gallons; one brass tank 1,000 gallons, and in addition tanks for various oxidized finishes. There are three double plating barrels and two extra large burnishing barrels.

In this general plating room, there are three generators having a total capacity of 3,000 amperes.

One of the tanks in this department is 17 feet long and a method has been developed for plating work up to 34 feet in length: that is, twice the length of this tank.

Another special buffing and polishing shop has fifteen

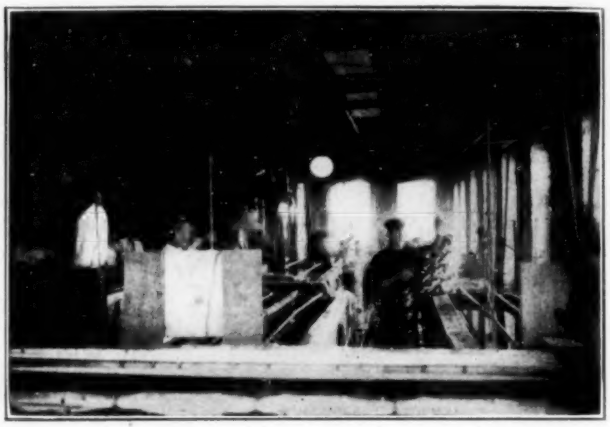


FIG. 4—NICKEL PLATING ROOM

double spindle grinding and polishing lathes. This department is used partly for repair and general work around the plant and also for grinding and polishing work before, between and after plating operations.

The eighth floor of this building is used for storage of spare parts and also for outlets for the ducts, flues and exhaust pipes leading from the various plating and polishing shops.

The chromium plating room is on the sixth floor and includes six tanks with a double capacity of 4,500 gallons. There is a generator capacity of over 5,000 amperes. A specially installed and powerful exhaust system takes off the fumes from each chromium plating tank. The room is well ventilated by means of this exhaust system and

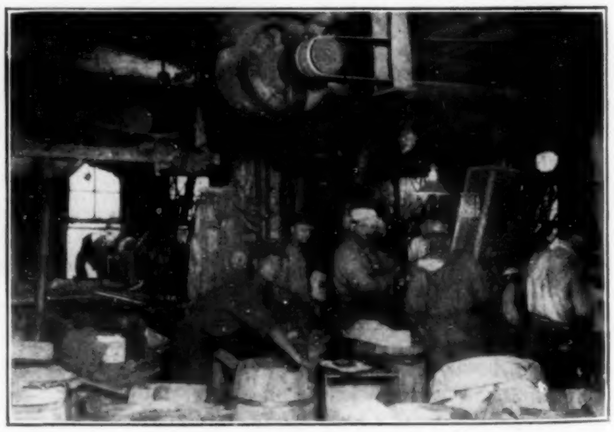


FIG. 5—GRINDING AND POLISHING

additional electric fans. Heavy rheostats and bus bars are used and there is special handling equipment for large and heavy work. The room is so laid out as to allow for additional tank capacity.

Another item of equipment is a special lacquering and

bronzing hood connected to the exhaust system, which is used for special finishes. In addition, there is, of course, the stock room for keeping supplies of polishing compound, buffs, emery chemicals and other materials used in the plant, spare parts for machines, etc. The office is so laid out as to provide for special space for the clerical staff and salesmen with private offices for Mr. Tillmann and Mr. Katz.

The Tillmann Works are now specializing on high grade chromium plate, a special fine hard finish. They are doing a considerable amount of work for the automobile trade. The standard of their work is shown by a letter sent to them recently by the Uppercu Cadillac Company of New York, in which it was stated that the work on every car was found very satisfactory, in fact the best they had ever had. Splendid results had been obtained in respect to fine color and remarkable hardness of the metal. The capacity of the plant as outlined above is ample for large volumes of work and the company is bending every effort to turn out the very best possible finishes in all metals, with chromium as the leader.

New Hood for Chromium Tanks

In an effort to remove all danger from the fumes generated by the operation of chromium plating solutions, the A. Y. McDonald Manufacturing Company, Dubuque, Iowa, manufacturers of pumps, cylinders, well and pumping supplies and other metal goods for water, steam and gas, has designed an interesting as well as novel means of keeping the fumes controlled and away from operators.

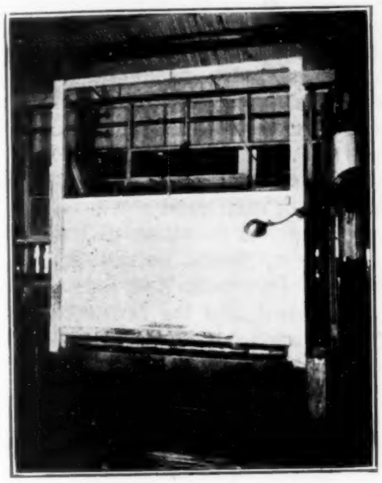


FIG. 2—HOOD CLOSED

The hood is made of wall board. It is of very simple construction and is easy and inexpensive to install. It is a fairly large housing, having three stationary sides and a sliding front which is operated easily on a counterweighted pulley. One of the accompanying illustrations gives a view of the housing with the sliding panel raised to give the operator access to the tank and the other shows the slide closed as during operation, when the fumes are being generated. The tank in the illustration is near a window, so that the rear of the hood has been left open, permitting the fumes to escape through the windows. The single electric light attached to the frame illuminates the inside of the hood satisfactorily, it is stated.

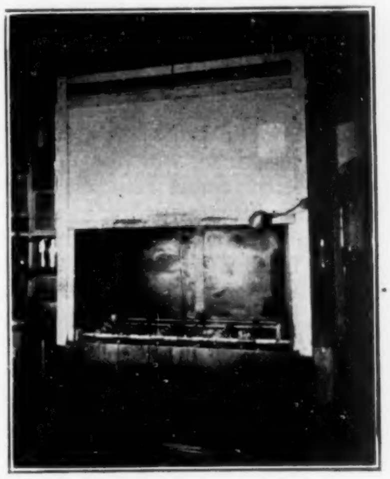


FIG. 1—HOOD OPEN

Where it is not practicable to have the tank immediately before a window, the housing could probably be fitted with a stack through which either a forced or natural draft would draw the fumes off. The McDonald company's superintendent, J. M. McDonald, states that this housing has enabled that concern to remove chromium fumes completely.

Electrodeposition of Aluminum Perfected

A method whereby it will be possible to deposit aluminum by an electrolytic method has been announced by Professor D. B. Keyes of the University of Illinois, who has done considerable research in this field. Speaking at the recent meeting at Chicago of the American Chemical Society, Professor Keyes declared that the perfection of aluminum plating would lead to savings of millions in many lines of industry. Aluminum plating has long been the subject of intensive research and has heretofore baffled all attempts. The process devised by Professor Keyes, therefore, should be of great importance if it can be turned to large-scale, commercial production. He is quoted as saying that aluminum plating will be adopted by producers of many things, including kitchen utensils, oil refinery equipment, locomotive parts, equipment for containing acids and sulphur compounds, and many other articles. The following is taken from Professor Keyes' address:

"Aluminum alone has very little tensile strength or elasticity. This prevents its use as a structural material in spite of its light weight. The aluminum alloys are superior in these properties, but will not stand corrosive agents. It therefore becomes necessary to apply a thin continuous coat of aluminum free from holes, to steel and other metals.

"This has been done at the University of Illinois by a new and different method of electroplating. It is impossible to electrodeposit aluminum from a water solution. The new method makes use of organic metallic complexes that are liquid at ordinary temperatures, or at temperatures slightly above."

Professor Keyes expressed the belief that this new method will have universal application to all metals. "It should be possible," he said, "to electrodeposit any metal desired, even though it is impossible by the old technique.

At the same meeting Professor Keyes declared in an interview that the modern lacquer which has meant so much to the automobile industry would be entirely replaced by a new and vastly superior finish.

"This finish will have the same quick drying qualities, but will have increased durability and lustre. It will be soon possible to apply a mirror-like clear finish on the top of the pigmented coat which will resemble the old 'piano' varnish and still retain the durability of pigmented lacquers—something that has never been done before."

Sampling and Evaluating Secondary Metals

A Complete Description of the Precautions Necessary in Sampling Scrap—Part 4, Conclusion*

By T. A. WRIGHT

Secretary, Lucius Pitkin, Inc., New York

A PAPER READ AT THE NEW YORK MEETING OF THE INSTITUTE OF METALS DIVISION, THE AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS, FEBRUARY, 1928

BRONZE POWDER

This material is so fluffy that it causes a great amount of trouble. It flies about and sticks to everything and should not be handled near other lower grade stuff.

AUTOMOBILE RADIATORS

Automobile radiators are not sampled but are sold on weight less iron, which is in the water connections, plates, strips, etc. Some refineries have their own list of iron deductions for radiators, as does The National Association of Waste Material Dealers. The iron deduction will range from 2 to 20 lb., the latter from truck radiators. Fords will show from 2 to 9 lb.

The remainder is chiefly copper, brass and dirt. The solder will average about 7 per cent. The recovered solder may contain as high as 40 per cent tin. Some dealers dismantle and ship the cores; others sweat to recover the bulk of the solder. The tendency at present is to use less tin than formerly in the solder, so the figure given for that metal will probably be too high for the future.

JEWELRY AND DENTAL WASTE

An entire paper could be devoted to this important and valuable material but only the phase that affects the larger smelter will be taken up here. There are innumerable establishments making jewelry and many small dental laboratories spread over the country. The waste from the floors, sinks, benches and furnaces, etc., is saved and collected by small dealers who are usually called "refiners." Combustible matter is burnt by them to ashes, which are called "sweeps."

Metallic waste, such as clippings, punchings or stampings, is usually cast into bars called "bullion." Other names are "platers' scrap" and "filled clippings." Only the low-grade type of bullion free from the platinum group will be discussed.

SWEEPS

This material is always shipped in barrels or drums, usually sealed. Shipments vary from 1 to 7 bbl., rarely more. The entire lot is spread out on a clean floor and thoroughly mixed by shoveling, coning and quartering. It is often hygroscopic, because of the presence of sodium salts from cleaning solutions, and the moisture will run from 0.3 to 1.5 per cent. A sample for moisture is best taken at the time of dumping the barrels and immediately after weighing. This sample is usually dried at the works in the presence of the shipper's representative. As a steam bath is used, about 0.10 to 0.15 per cent of moisture is usually left. The main lot having been quartered down carefully to about 12 lb. maximum, the sample, consisting of two opposite quarters (the other two being held as a reserve), may be placed in a pebbled-mill or bucked down by hand on a bucking-board and sieved through an 80- to 120-mesh sieve, preferably the latter, to remove the scales or metallics. These will rarely run over 2 per cent, as in most cases the shipper has already sieved the sweeps through an 18- to 60-mesh screen before shipping.

The sample should be weighed **before grinding** and the metallics weighed **after screening.** The fines weight is then taken by difference. On account of dusting losses, an improper ratio would be obtained if this were not done. The fines or pulp is then mixed, quartered and bottled.

The metallics is unhomogeneous in value and particle size and, being small in amount, should be scorified with an excess of lead to 20 to 100 gm. poured in a small button or slab. The slag is cleaned and the button rasped, quartered and divided into three portions.

Fines and metallics are assayed separately for precious-metal contents only. No allowance is made for base metals.

Some works, instead of taking the struck weight of two quarters, weigh out, grind and sieve definite weights such as 16, 20, 30 or 40 assay tons. This is not recommended, for while it is convenient for calculating, it is wrong in principle.

WATCH-CASE BULLION OR PLATERS' SCRAP

This material is very valuable. Silver will run from 1 to 50 per cent, gold from 2 to 15 per cent and copper from 50 to 80 per cent. Payment is made for all three, the balance of the alloy being chiefly zinc and nickel.

It is shipped generally in bars, the shipments rarely exceeding 13,000 oz., as that is the full capacity of the crucible used for melting. The entire shipment, after weighing, is melted with a little borax and charcoal to a clean melt. The slag is skimmed off and poured into water to remove the bulk of the remaining charcoal, then dried and reserved.

The molten mass is stirred vigorously by plunging an iron ladle up and down with a twisting motion. A small hot clay crucible is then dipped into the metal and a shot sample taken by pouring into a pail of water in which a wooden board rests. The hot metal is thus spattered under the water, the object being to make as little "matted" shot as possible. The very fine shot should be screened out after drying and the very coarse picked out, only the medium size, about 18 to 40 mesh, being used at one refinery, and 1/8 to 1/4 in. at another. The coarse assays the same but is awkward to handle at the balance; the fines will carry any slag or dirt inadvertently carried over from the surface of the melt, and should not be used for assay, as it also has a greater tendency to oxidize, by reason of the zinc present.

The metal is ladled out into bars and weighed, and the

* Parts 1, 2 and 3 appeared in the issues of June, July and August, 1928.

slag reserved as described above, is thrown into the crucible. The heat is raised and the pot sweated. The metal recovered is poured out, cleaned of charcoal and the total metal recovery weighed. The assay is figured on this after-melting, or A. M., weight. The treatment charges may be based on the before-melting, or B. M., weight.

A long series of experiements initiated by this laboratory and carried out some years ago at one of the refineries proved that, even on the highest grade material, no segregation troubles occurred provided the melt was thoroughly mixed, as described above. It was feared that the combination of high gold, zinc and a high-melting metal—nickel—might result in an erroneous figure if the sample was dipped from near the top. The assays of samples taken at intervals from the bottom to the top by this method showed accordant results.

Small bars, however, weighing only a few hundred ounces or less may be drilled in six holes diagonally across the bar, drilling through each time. It is very difficult to pour clean enough on a small weight to obtain a true A. M. weight, so a melted or shot sample is not always taken. The last method gives a more homogeneous sample, however.

As these small bars often contain large amounts of platinum metals the relative accuracy of the two methods should be ascertained by a series of carefully controlled experiments on actual shipments.

Metals of Superstrength

By JAMES SILBERSTEIN

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

Remarkable improvements in the art of imparting hardness and strength to metals have been made in the last few years. The old method of hardening by alloying and mechanical working is being seriously threatened by methods in which heat treating is an important feature. The requirements on strength of metals are being steadily increased since the use of stronger metals is equivalent to reduction in weight, reduction in cost and increased efficiency.

Sixty years ago, wrought iron having an elastic limit of 25,000 pounds per square inch and an ultimate tensile strength of 60,000 pounds per square inch was used almost entirely in construction work. Today it is substituted—in cases where strength is important—by heat treated steel having an elastic limit of 70,000 to 100,000 pounds per square inch and an ultimate tensile strength of up to 150,000 pounds per square inch. Aluminum alloys having an elastic limit of 25,000 pounds per square inch have been replaced by heat treated aluminum alloys having an elastic limit of 50,000 pounds per square inch and an ultimate tensile strength of up to 85,000 pounds per square inch. The strongest copper base alloys which are in use at present have an elastic limit of about 80,000 pounds per square inch and an ultimate tensile strength of 125,000 pounds per square inch. Quite recently a beryllium copper alloy has been developed which can be hardened and strengthened by heat treatment so as to give an elastic limit of 180,000 pounds per square inch and an ultimate tensile strength of 205,000 pounds per square inch.

These figures are very respectable, even when compared with those of high grade alloy steel. Since copper is one of the most important of the non-ferrous metals, a speculation as to the extent to which it can be expected to be made possible to harden copper might be of interest.

The ultimate tensile strength of the purest aluminum which has been produced is about 8,500 pounds per square inch for the annealed metal. The first aluminum alloys for which heat treatment was essential to develop their full strength and hardness had an ultimate tensile strength of 50,000 pounds per square inch. The present heat-treating aluminum alloys have an ultimate tensile strength of 85,000 pounds per square inch, which is ten times the strength of soft aluminum.

Pure copper has in the annealed state an ultimate tensile strength of approximately 33,000 pounds per square inch. Based on what has been accomplished with aluminum alloys, it appears, therefore, that it should be possible to develop copper base alloy having an ultimate tensile strength of over 300,000 pounds per square inch. It must be remembered that research work on aluminum alloys has been steadily pursued for over 17 years; research work on copper alloys susceptible to heat treatment is of comparatively recent date and considerable progress is to be expected, therefore.

The heat treatment necessary for increasing hardness and strength of these and similar alloys consists in heating the metal to a certain definite temperature and holding it at this temperature for a time sufficient to bring about complete diffusion and solution in the alloy of one or more intermetallic compounds. (A metal does not need to be in the liquid state to dissolve another metal; diffusion and solution may take place in the solid state although it is very much slower). The next operation consists of quenching in hot or cold water. The metal is then "aged" at either room, or a certain elevated temperature which causes the intermetallic compounds to precipitate in microscopic particles in the alloy. This precipitation results in increased strength and hardness, and the method is therefore called "precipitation hardening."

Chromium Plated Automobile

Readers who attended this year's Indianapolis Auto Race probably noticed Earl Devore's Chromolite Special Miller car. Instead of paint, the exterior was finished all over with chromium plate. This demonstrates the possibilities of the chromium finish, as even the body, frame, axles, wheels, springs and engine parts were bright chromium plated.

The wearing qualities of chromium were utilized by plating the main bearing journals, crankpins, wristpins and valve cups. Due to the hard chromium surface on the crank-shaft, babbitt was dispensed with and an aluminum alloy was employed for the bearing surface.

The chromium plate was very thin but survived the race with only minor scratches. Chromium is one of the few metals able to stand up against friction with aluminum alloys; most steels are not hard enough for such use. The combination of chromium surfaced shaft or rod bearing against Lynite aluminum alloy appears to afford distinct advantages over the usual combination, steel against babbitt. —P. E. EDELMAN.

Defects in Fabricated Copper

A Discussion of Their Sources and Prevention by Dr. Römer in Metallwirtschaft for October 25, 1927*

Translated by WILLIAM ADAM, JR.
Electric Furnace Department, Ajax Metal Company, Philadelphia, Pa.

EFFECTS OF HYDROGEN

The effects on copper earlier erroneously ascribed to oxygen, have since been proved to be due to hydrogen, which, it is true, can occur only in copper containing oxygen, i.e., when the oxygen is present as an oxide. It is to the credit of Heyn for having first called attention to this. Bauer and Vollenbruck have recently shown an excellent and practical example of the irremediable effect of hydrogen as a constituent of illuminating gas and other reducing gases. In a wire sample, sent to a certain testing laboratory, fine hair cracks were visible on one side of the wire, which upon being bent about a mandrel was completely torn apart when the good side of the wire was laid against the mandrel. But when the perfect side of the wire was placed away from the mandrel no tearing occurred. It could be ascertained from a picture of the material that the cracks extended further into the interior and that they were partly filled with cuprous oxide, whereas there was no oxide present in the other material on this side of the wire. The center was also free of oxide, but the side of the wire having no cracks had a conspicuous quantity of cuprous oxide present. Therefore, at first glance, there did not seem to be any great difference in either exterior side of the wire. According to information received, however, the pieces were heated in a strongly reducing gas prior to rolling. This led to the presumption that the absence of cuprous oxide in the interior of the cracked side—oxide was found only in the outer crevices—was caused by the reducing action of the gaseous atmosphere. This preheating was in a furnace in which the flame passed over the top side of the bar only. Therefore, the oxide on this side could only be reduced by the penetration of hydrogen, resulting in steam being formed in the interior which exerted a great pressure. This gave rise to the hair cracks when rolled which upon subsequent bending caused enlarged cracking. The imprisoned cuprous oxide found in the cracks could have been formed only by renewed oxidation from the outside. Check experiments made in the material testing laboratory established the fact that when the preheating was done in an electric furnace, the wire was free of all cracks and could be bent about a mandrel without breaking, although the wire contained cuprous oxide. When the annealing was done in illuminating gas, this was not possible. On the other hand, a copper wire containing no cuprous oxide whatever showed no evidence of cracking even when annealed in an illuminating gas atmosphere. From this it is very clearly seen that one should never allow copper containing oxygen to come in contact with reducing flames, and if no other flame is available, the heating of the copper should be done in a protected furnace. According to Smith and Hayward, this detrimental action of hydrogen is greatest at a temperature between 700 and 800° C, while at lower and higher temperatures an evident opposing action occurs. At the higher temperature ranges, probably the cracks are again sintered together, so that it is actually possible to improve the properties of hydrogenized copper by heating in nitrogen at 800° C. Leiter has confirmed this and showed pictures of the sintering action. Other conditions remaining the same, the depth of penetration of the hydrogen is dependent upon the oxygen content in a most interesting manner. The details of these experiments, which are too complicated to be given here, showed that copper bars, unsuited for the trade due to a hydrogen treatment, could be remedied by a very definite treatment. For instance, copper, requiring a very low resistance for electrical purposes, can be completely reduced with hydrogen, but it must then be enveloped in a copper sheet and heated in a furnace with a non-oxydizing flame and immediately rolled hot. The first passes should be as heavy as possible and the protecting sheet must, of course, be held on sufficiently tight. The higher the degree of rolling, the better this action is supposed to be. Bassett and Bradley arrived at similar conclusions regarding the depth of penetration, namely, the smaller the original oxide content the greater the hydrogen will penetrate into the interior within a given time. Therefore, the speed of penetration is greatest at the top surface, and diminishes with increasing depth. According to Fuller, other reducing gases, which contain hydrogen act exactly the same as hydrogen, as for instance in the oil firing of muffle furnaces or welding. Also traces of fatty substances being deposited on the pieces may cause defects upon subsequent heating of the work, as has been observed in the filaments of X-ray tubes.

EFFECTS OF OTHER IMPURITIES

An indirect hydrogen ill may be caused by iron, since this metal always contains traces of hydrogen. As Siebe showed, if one alternately heats oxygen-free and oxygen bearing copper sheet or wire in tight contact with iron, blisters will form on the oxide-sheet and cracks will appear in the wire which contains oxide, when bent, while the electrolytic copper will remain unchanged. The other experiments, which are of the greatest importance to the iron copper plating industry, have led to the conclusion that it is not only the hydrogen present in iron that effects a reducing action, but also carbon monoxide, which acts in the same manner. According to Sieverts, carbon monoxide does not go into the iron. However, experiments by Beckinsale and Moore showed that a reducing action does occur—a result which does not refute Siebe, if explained by the fact that the carbon monoxide first reduces the outer oxide particles, thereby exposing fresh particles and so traces its way between the copper particles. These results are important because they show that copper must be protected from gases free of hydrogen but containing carbon gases due to incomplete combustion—although the attack is slower in this case.

Sulphur must also be considered as a detrimental impurity in copper. However, Siebe says the impurities in refined copper are so great due to the furnace gases and

*Conclusion. The first part of this article appeared in the August, 1928, issue.

original impurities present that it is difficult to decide on the effect of sulphur on the cold or hot shortness. On the other hand, sulphur enters the very pure crucible coppered by virtue of the coke—taking the form of cuprous sulphide or as sulphur dioxide, depending on whether and how much oxygen is still present. The sulphide acts similar to the oxide—the soundness qualities being impaired in but very few cases and then only insignificantly. In fact, this impairment is less than that with oxide, because the sulphide is more plastic. Furthermore, sulphur combines with other hardening impurities and thereby makes them unharmful. Sulphur dioxide causes a decided swelling of the casting when poured and leads to porous castings, which results in cracks and cleavage later on. Since the presence of oxygen is seldom preventable, a marked amount of sulphur will have a disadvantageous action in most cases.

On the other hand, the presence of lead and tin has no detrimental effect, according to Pilling and Halliwell, providing that oxygen is present and that the combined amount of lead and one-half the tin does not exceed the oxygen content. If more than enough tin to satisfy this condition is present, the electrical conductivity will be reduced but the strength will not be altered. If more than the conditional quantity of lead is present the rolling qualities will be impaired—especially cold rolling. For example, wire bars of .03 per cent lead and tin are equal to electrolytic bars in working qualities and conductivity.

Finally a type of arsenic copper ill has become known, which in its effects resembles the well known season cracking in brass. It also manifests itself as tearing in greatly stressed pieces—for instances, drawn tubes. Pinkerton and Tait have shown that this occurs only in the presence of arsenic. Copper with a hundredth per cent will not show this effect, but a content of .44 per cent arsenic will cause tearing, even though the same pull is employed. Arsenic evidently limits the grain strength and thereby the resistance to internal stresses. On the other hand, it acts against the influence of oxygen more readily, according to Bamford, i.e., it retards the formation of oxide and thereby the sensitiveness to hydrogen ills.

In conclusion, the table below includes a summation of the defects in copper described above, together with their remedy or prevention.

One can see that items b, d and e in part II of the above table are not traceable to the cast material, but it is a matter for the manufacturing department to prevent these harmful defects manifesting themselves. Although the research up to this time has not completely exhausted the technical means of avoiding all these copper ills, at least the structure troubles, it is of great economic significance to all plants and, therefore, the whole copper industry of Germany to avoid these copper ills by means of technical control.

Summary of Defects in Copper

I. TROUBLES DUE TO METAL STRUCTURE

Ills	Damage in Working	Cause	Remedy	Prevention
(a) Interradiated metal		Impaired strength of stem crystals in long direction	5-10% pre-rolling and annealing at 750° C	
(b) Porosity	Tearing and cracking during first passes in hot rolling	Concentration of pores in the casting skin and in stem crystals	Removal of casting skin	Quiet and slow pour at low temperature. Heavy walled and medium warm molds
(c) Internal Elastic stresses		Casting stresses	Annealing	

II. TROUBLES DUE TO IMPURITIES

Ills	Damage in Working	Cause	Remedy	Prevention
(a) Oxygen	Blemishes in polishing finished work	Excessive oxygen absorption in the air-cooled layer	Removal of layer which was air cooled	Minimizing oxygen absorption in cooling the casting
(b) Hydrogen	Fine hair cracks and fragility in bending	Formation of cavities by steam from hydrogen and cuprous oxide	Tempering in nitrogen at 800° C, or heavy rolling with copper shell after pre-heating in a non-oxidizing flame	Avoid contact with hydrogen containing flames
(c) Carbon Monoxide	Formation of small blisters or cracking	Cavities formed by carbonic acid from carbon monoxide and cuprous oxide	Probably the same as (b)	Avoid contact with carbonaceous flames
(d) Iron	Formation of blisters and cracking when in contact with iron	Gases from iron same as in (b) and (c)	....	....
(e) Sulphur	Swelling of casting, porosity cracks and tears in rolling	Formation of sulphur dioxide from sulphur and cuprous oxide	....	Avoidance of sulphur
(f) Lead and Tin	Reduction in conductivity or cold working qualities	Total content of lead and one-half of tin in excess of oxygen content	....	Avoidance of lead and tin
(g) Arsenic	Season cracking	Reduction in limit of grain strength	....	Avoidance of too much arsenic

Methods of Joining Aluminum and Its Alloys

Soldering—Autogenous Gas Welding—Electric Welding—Cast Welding and Riveting—Part 1

By A. EYLES

Foreman, Sheet Metal Working Department, London, Midland and Scottish Railway Company, London, England.

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

History has recorded Ages of Stone, Copper and Bronze. The present is generally known as the Age of Iron and Steel. Will our civilization continue indefinitely on an Iron and Steel basis or will Aluminum in the near future displace it?

When it is considered that relics of copper, bronze and iron have been found in Egypt, in the ruins of Nineveh and other cities dating long before the opening of the Christian Era, so that, while no sharp line separates them from the preceding Stone Age, many of these relics are from 3,000 to 7,000 years old, it will be seen that aluminum, approximately one century old is historically a young metal compared with other common metals. In the annals of commercial enterprise there is, probably, no more interesting memoir than that of the birth and growth of the aluminum industry, with its phenomenally increasing output during recent years. Consequently, it is not extravagant to suppose that the present Iron and Steel Age may be succeeded by an Age of Aluminum in the near future.

The ever-widening use of aluminum and its alloys has brought with it the question of how to make repairs. A permanent repair or joint in aluminum is entirely satisfactory when correct methods are employed; but unfortunately there are two many incorrect methods, which make many mechanics not only indifferent, but adverse to the repairing of fractured or broken aluminum parts. Since the jointing of aluminum and aluminum alloys is generally considered to be a difficult process, a few notes from one who has spent upwards of twenty years in research work, involving the investigation of various methods for making joints in the metal for the assembly of structures and the repairing of fractured or broken aluminum and aluminum alloy products and components, should be of practical value and general interest.

The art of jointing most industrial metals has been known and practised for many centuries, but this is not the case with aluminum, since the use of this metal is only in its infancy, as compared with other common metals. Aluminum was obtained first in 1827, but at this period it merely consisted of a whitish-gray powder and it was not until 1845 that metallic globules or pellets were obtained. However, the jointing of aluminum was not accomplished until the year 1855, when M. Christofle, a goldsmith, in Paris, discovered that pure tin would solder aluminum, but not effectively, as the tin formed an alloy with the aluminum and was decomposed by oxygen. It is only since the introduction of autogenous welding by oxyacetylene and oxyhydrogen methods that satisfactory progress has been achieved.

SOLDERING ALUMINUM

The question of soldering aluminum is a greatly debated subject, and possibly rightly so, because few mechanics can make a permanently sound joint. It is well known to those accustomed in the art of soldering metals, that there is no solder that acts with aluminum or even aluminum alloys, in the same way that ordinary soft solders operate with brass, copper, nickel and tin plate. Indeed, it is incorrect to speak of soldering aluminum—especially with relatively high-melting solders—as an ordinary tinner or tinsmith means soldering—with a hot copper and a solder that will flow and follow it speedily. Aluminum and its alloys are not soldered that way. A higher degree of heat is required to solder aluminum than can be conveyed by means of the ordinary soldering copper. It is well-known in metal-working plants that all forms of soldering require the application of the proper amount of heat in order to make a strong and permanently sound joint, and that the temperature required varies with different metals, irrespective of the solder or flux used. In many cases failures in soldering aluminum can be traced to incorrect regulation of the heat used in making the joint.

Innumerable attempts have been made during recent years to discover an effective and easily used soft solder for aluminum. Some idea of the energy which has been devoted in developing special compositions of solders for aluminum can be gained from examination of the plant specifications and inventions in the United States and in European countries.

During the last twenty years the writer has tested many aluminum solders and has made joints with them that were to all appearances quite satisfactory, and has been assured that the joints would retain their strength for an indefinite period. Most of these guarantees have not been fulfilled. On subjecting new joints to severe tests the metal was invariably broken at varying distances away from the soldered joint, and it was extremely difficult to make a new joint yield. After the lapse of a few months, however, the parting of the two pieces of aluminum at the soldered joint presented very little difficulty, thus proving that many of the so-called aluminum solders are not permanently satisfactory unless protected against corrosion.

The following is a case in point with reference to the disintegration of aluminum solders in damp situations. Some few years ago the writer made two triangular shaped aluminum vessels of sheet aluminum, 0.036 inch in thickness. The joints were made by using a solder composed of tin, zinc and aluminum. One of the vessels was used for filtered water in railroad passenger car service, and the other for dry materials; both were made at the same time and by precisely the same process. After a lapse of a few months the vessel that had been used for the water came back to the railroad car repair shops for repairs, the defect being that the joints were leaking. Upon examination, it was found that the solder had badly disintegrated; in fact, the greater portion of the solder could easily be stripped off the aluminum, whereas with the other vessel the solder is still in good condition. The writer has several soft soldered specimens of aluminum, as well as aluminum soldered to brass and steel, that were jointed about twenty years ago. These are also perfect; but it must be stated that the specimens

referred to are not exposed to severe conditions, such as spray of sea water (which rapidly deteriorates aluminum soft solders), or a damp atmosphere.

To determine the feasibility of soldering aluminum with the various soldering compositions, a series of tests was made about five years ago by the U. S. Bureau of Standards, the results of which are given in Circular No. 78. Solders for Aluminum. It may not be out of place to mention that the bibliography included an article on "Soldering and Brazing Aluminum" by the present writer published in December, 1914, **Machinery**.

Experience gained during the past twenty years proves that aluminum and aluminum alloys can be soldered but not so readily and effectively as other common metals; also that the number of solders available that will give a permanent joint is limited. The main obstacles to an easy and permanent process are:

(1) The refractory oxide film, which is intensified at soldering temperatures, and prevents ordinary low-melting solders from alloying with the light metal.

(2) The thermal conductivity and high specific heat of aluminum renders local heating to the alloying temperature a tedious operation, more particularly as the size of the component or product worked on increases. Thus the heat is conveyed from the soldering copper and solder so rapidly that they become chilled quickly, and, therefore, the solder does not become sufficiently liquid to flow readily.

(3) The highly electro-positive character of the metal causes galvanic action to be set up with most of the alloys in solder composition. Thus an apparently strong and sound joint may, owing to internal electrolysis disintegrate within a comparatively short period. Especially is this the case on exposure to moisture or a humid atmosphere. Soft soldered joints should, therefore, only be used where they are not exposed to a damp atmosphere. It is desirable, whenever possible, to apply some coating of efficient protective paint, varnish, or plastic composition to the soldered joints.

In soldering other metals the oxide can be removed chemically. With aluminum or aluminum alloys in the absence of an efficient soldering flux, the oxide is best removed mechanically by abrasion, such as scraping. The scraping must be thoroughly done, because the strength on the soldered joint depends to a great extent on the efficiency with which the oxide is broken up, or removed from the surface. Since the oxide film forms again on exposure to the air, instantaneously, it is necessary that the removal of the oxide and the covering with solder should be simultaneous.

It would be difficult to mention a flux that has not been recommended or tried for soft soldering aluminum. No soft soldering flux has yet been discovered that will allow the metal or its alloys to be soldered with the same speed and reliability as can be attained in soldering brass, copper, iron, steel, nickel, monel metal, etc., with ordinary commercial fluxes. Experience gained luring the past twenty years proves that the low-melting solders are best applied without a flux after preliminary cleaning and tinning of the surfaces to be soldered. In fact, the use of fluxes in soldering aluminum is a hindrance to most work.

The composition of an aluminum solder may be varied within fairly wide limits. Most aluminum solders consist of a tin base, with the addition of aluminum and zinc, the chief function of which is to produce a solder that can be reduced to a semi-fluid condition within the range of soldering temperatures. Some aluminum solders contain antimony, bismuth, cadmium, copper, lead, nickel, silver and other metals in addition. In Germany several "hard" solders are used. These consist mainly of aluminum and have relatively high melting points; in fact, the customary soldering coppers are useless for jointing, a gasoline or acetylene torch flame being essential.

The writer has been questioned many times during recent years as to the utility of these so-called "hard" aluminum solders, and the reply given is that they have little or no real value in industry, chiefly owing to their relatively high-melting point—approximately 100 deg. C., below that of aluminum, 658 deg. C.,—and more particularly to the ease and reliability with which aluminum can be jointed by autogenous welding with the oxyacetylene and oxyhydrogen flame.

The success of the soldering operation mainly depends on thoroughly tinning the parts to be soldered. The process of tinning is best accomplished by heating the parts to be joined to a temperature somewhat above the fusing point of the solder used and then rubbing the surface with the point of a tinned steel tool so as to break up or remove the oxide film and allow the solder to operate upon the clean surface. The higher the temperature—within certain limits—at which the tinning is done, the better will be the adhesion of the tinned layer. After the areas to be joined are properly tinned, they can readily be soldered together by pressing the tinned areas in contact, again heating the metal and solder to the requisite temperature, and finally by rubbing thoroughly with a tinned—correctly heated—soldering tool, the surfaces carrying the liquid solder. The best method of working is to use a gasoline or kerosene torch flame to heat up and play on the metal during the soldering operation—particularly, if the parts or castings to be soldered are of fairly large dimensions. The flame employed, however, must have no free carbon.

To test the efficiency of aluminum soldered joints various methods are practised. One method is to boil a soldered joint for about half a dozen hours in water that is slightly salt. Another test to which a soldered joint can be subjected is that of playing steam on it for several hours. Soft soldered joints which have the appearance of being satisfactory and which are apparently mechanically strong (within the limits of the solder) fail when exposed to steam. Another good method of testing aluminum-soldered joints is to make up a few flat-lap joints or seams in sheet aluminum of thin gauge, and boil them in distilled water. If a joint stands up to that boiling for say, 50 to 60 hours without disintegration it is considered a good solder.

The tensile strength of a good aluminum solder is about 7,000 pounds per square inch—much less than that of aluminum and its alloys. Solder having a higher tensile strength usually require such a high temperature for soldering that they are exceedingly difficult to use in the manner described—an oxyhydrogen or oxyacetylene torch flame being the most suitable.

The strength of any soft soldered joint in aluminum and aluminum alloys depends upon the type of the joint, the solder, and the skill used in soldering. A perfect union, or cohesion between the solder and the aluminum is very difficult if not impossible to obtain. Too much dependence should not be placed on the strength of a soft soldered joint. To withstand vigorous tests such as, shock, vibration, tensile, corrosion, etc., nothing short of autogenous welding with the oxyacetylene or oxyhydrogen torch flame is sufficient.

The art of autogenous welding with the oxyacetylene and oxyhydrogen torch will be dealt with in an early issue. This method of welding has the advantage over heterogeneous soft soldering methods of joining aluminum and aluminum alloys, which invariably introduce alloys of a different position on the electro-chemical scale, setting up galvanic action and all the evils of electrolysis and subsequent corrosion.

This article will be continued in an early issue.—Ed.

The Fundamentals of Brass Foundry Practice

A Description of the Basic Laws Which Control the Melting and Casting of Metals and Their Application to Practical Foundry Work*—Part 18

By R. R. CLARKE
Foundry Superintendent

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

The time difference in filling a mold from the top down as against from the bottom up is practically negligible. Hydrostatics affirm and practice will prove this. By hydrostatics, speed and volume of current through any delivery is governed mainly by the sprue pressure which reverts to the sprue height of metal. Other factors are metal fluidity, increasing gaseous pressure and the greater surfaces of friction engaged as the metal rises. Fig. 60 furnishes the study. Top gate B kept filled in pouring generates a 2 pound per sq. in. driving pressure and discharges into the mold without resistance. Every factor in gate B is a constant and it will pour evenly and uniformly throughout. In bottom gate A all factors of current, such as pressure, congelation, friction, etc., are variables. It will, therefore, not pour uniformly, being much faster than gate B at the beginning and considerably slower at the finish of pouring. Any observant molder will notice this distinction between top and bottom pouring and may know that it is derived exclusively from increasing surfaces engaged, from the advancing viscosity of the metal, from rising pressures of mold gases as the metal rises in the mold, and not to the mere fact of greater weight or quantity of metal in the mold. Height of metal in the casting mold is, of course, a factor of resistance, but if the metal of sprue A in pouring be kept always 7 inches higher than the level of the rising metal in the mold as at R and S, then from the standpoint of pressure, the bottom delivery would carry uniformly and with equal speed and volume as top gate B. Friction, congelation, etc., of the rising metal of course prevent this and slow up the bottom delivery. But as the delivery is retarded, the sprue metal mounts to higher levels, immediately increasing pressure and overcoming resistance. The thing is, therefore, automatic, self-adjusting and averages up to practically the same result as the constant of the top pour. Purely theoretical as this may appear, it is nevertheless exactly what practice will substantiate. Any molder can easily test it out to his own satisfaction.

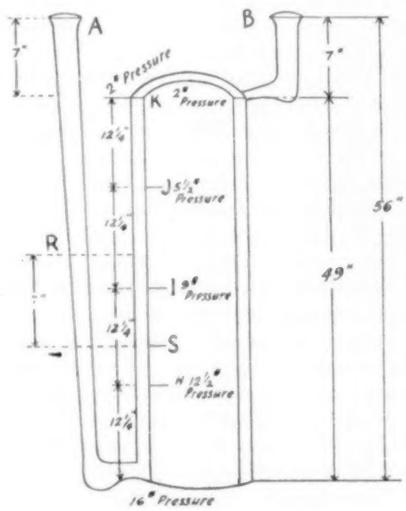


FIG. 60—TIME STUDY

The interesting question here suggests what would be the relative time of filling the mold from either gate if both gates in pouring were kept level full from the beginning. The drop pouring method answers the question and shows that under fair conditions of fluidity throughout, the bottom gate is decidedly the quicker. Under full pressure of a gate so filled, the first driving effect at the bottom is 16 lbs. per sq. in. As the rising metal passes points H-I and J—pressure reduces to 12½ lbs., 9 lbs. and 5½ lbs., respectively. At the top point K it drops to 2 lbs., the same as the top gate B. From this it will be seen that "the driving power of a filled bottom gate at any metal level in the mold is the height of the gate head above that level."

This principle is clearly seen in the following. At the bottom of the mold the driving power is 16 lb. per sq. inch. Suppose the mold is to be ½ filled or to point I in the casting. The opposing pressure of this 24½" mold metal column is itself 7 lbs. per sq. in. We then have a 16 lb. gate pressure working against a 7 lb. mold metal pressure which reduces the effect of the gate pressure to the difference between the two or 9 lb. Now the height of gate head A above the casting, middle point I is 31½ inches which in pressure amounts to the same 9 lbs. In all the foregoing calculations, the specific gravity of the metal is taken at 8 and the formula:

$$\text{Pressure} = \frac{\text{Height x Sp.g.}}{28} \text{ used as } \frac{\text{56 Height x 8 Sp.g.}}{28} = \text{16 lbs. pressure}$$

So much for theory, which, though perfectly sound will not check to the line with practice because of the modifying influences of congelation, of friction, of increasing pressures of mold gases, etc., already referred to. The principles throughout, however, are of value in dictating and emphasizing practice in pouring bottom gated molds of thin section. After covering the mold bottom with metal, pour, at maximum. By vertical pour, either from top or bottom, a thin walled casting of depth and surface always includes a chance of mis-running. A locomotive chime whistle body, a thin walled bushing with inner chambers and webs will illustrate. Neither top nor bottom pouring alone will guarantee a full run casting. The only reasonably sure method, other than possibly double pouring or drop pouring, is to gate for delivery at bottom, middle and top all from the same drop gate. This has been the author's most successful practice for years in this class of work.

The second disadvantage of bottom pouring is the difference in temperature between the metal at the top and bottom of the casting at pouring finish and its effect on shrinkage. The top metal is then colder than any

 This series will be collected and published in book form. Parts 1 to 17, inclusive, were published in our issues of July, August, September, October and November, 1926; January, February, March, April, May, August, September, November and December, 1927; and March, April, May and August, 1928.

stratum of metal beneath it, when by all the laws of shrinkage it ought to be hotter. That is undoubtedly the ideal condition for logical feeding, to which condition the bottom pour in no wise functions. It is rather the attribute of the top method. The discrepancy, however, is not so extreme as opinion would sometimes have it. Fig. 61 is taken to illustrate and represents a vertical casting of bulk. First of all it must be understood that a casting can be fed from any position of supply, bottom up, side in, or top down. It muse be fixed also that any feeding metal must be hotter than any kindred metal fed up to complete solidification by it. Still further it must be beyond dispute that direct gravity is a strong factor in efficient feeding. Now a casting, vertically poured, ought by rights to feed itself automatically from its higher to its lower positions downward and draw on its top riser supplies to compensate its self-inflicted loss which naturally localize at its highest points. In Fig. 61 bottom gate C will conclude pouring with the hottest metal at the bottom, the coldest at the top of the casting. Top gate D will show exactly the opposite. Bottom gate C has at the bottom a 10 pound metal pressure gradually reducing upwards and terminating in a possible 2 pound metal pressure at the top. Top gate D has this same 2 pound metal pressure bearing downward instead of upward on the casting mass. Gravity is, therefore, the main distinction in this particular, and vastly favors the top gate feeding with gravity, as compared to the bottom gate feeding against gravity. The only way to approximate the top effect from the bottom is to use large delivery gates and

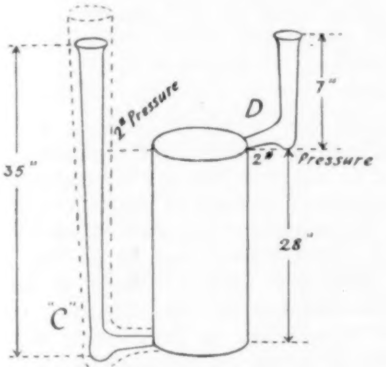


FIG. 61—VERTICAL CASTING

sprues in the bottom method and raise the sprue pressure substantially over that of the top method, because it is only through a preponderance of gravity forcing metal through slow-freezing gates that congealing metal can be forced upward to feed colder metal above it.

A very good plan often used by the author in particular castings is to gate for running at both the top and the bottom of such molds; this either by double pouring or by pouring through a runner box covering two pouring sprues, the one to the bottom, the other to the top of the mold. The sprue to the mold top is fitted up with a stopper core which is lifted after the bottom gate has run the mold ⅔ or ¾ full. In the case of double pouring, the top sprue is given metal when the bottom gate has filled the mold to a desired height. To ascertain when this desired height is reached it is only necessary to attach a gate and sprue at this desired point in the mold and watch for the metal coming into it. See Fig. 62.

The third disadvantage of bottom pouring is the more severe sand-burning and the greater strain on the casting in its deeper parts. The sand burning and the strain as well are due to the longer and more active prescence of hot fluid metal at the bottom when delivered from the bottom.

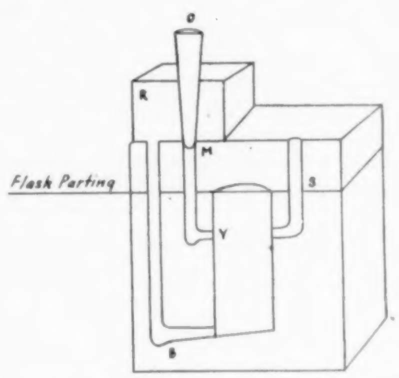


FIG. 62—B, BOTTOM GATE; O, STOPPER CORE; M, MIDDLE GATE; R, RUNNER BOX; S, SIGHT GATE.

A fourth disadvantage is the greater liability to run out at a mold position, where the run-out is most treacherous and stubborn. The sprue is necessarily closer the flask edge, its pressure much greater and the metal live throughout.

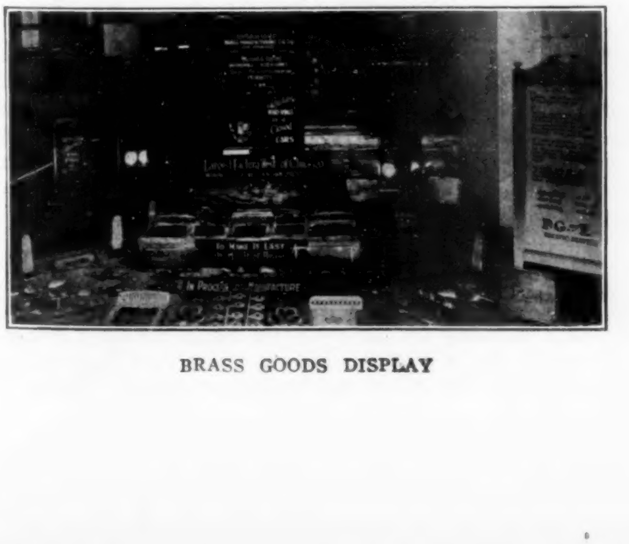
This series will be continued in an early issue.—Ed.

Illuminated Display of Brass Goods

An interesting display of automobile accessories built by the Golden Gate Brass Manufacturing Company, San Francisco, Cal., was made recently in one of the high intensity illuminated display windows of the Pacific Gas and Electric Company.

In order to demonstrate and reveal to merchants and their customers the dollar-and-cents value of properly utilizing, controlling and directing the illumination in their show windows and stores, the Pacific Gas and Electric Company has completed the most modern installation of window lighting anywhere in the country west of Chicago. These windows are dedicated to and are offered for use of the customers of the electric company as an added opportunity to display merchandise sold in their places of business and to permit the merchant to see his own merchandise properly illuminated and displayed. In this way the merchant can realize fully the ability of light to create sales appeal.

—Charles W. Geiger.



BRASS GOODS DISPLAY

Nickel Silver Pouring Temperature

While the average pouring temperature for nickel silver is in the neighborhood of 1900° Fahrenheit, the correct temperature for any given class of work is dependant upon the nature of the work. Nickel silver can be run safely at 2200° Fahrenheit. A suitable flux for sand castings of nickel silver is one-half per cent of aluminum.

—W. J. Reardon.

High-Temperature Crucible Furnaces

Some Pointers to Be Followed in Building Such Furnaces

By WILLIAM MASON

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

The manufacture of high melting mixtures necessitates the use of high temperatures, usually produced by the use of forced draught. To melt these metals either clay-lined plumbago crucibles or very refractory clay ones are needed, these being of barrel shape and holding about 45 pounds of iron cut up to pack as closely as possible. Covers are lightly luted on to exclude carbonaceous gases, which are freely absorbed at certain crucial temperatures below melting point. Usually four crucibles are placed in each furnace, although it is useful to have a pair of single-pot furnaces on hand when large weights of metal are not always needed. Forced draught at about 3 inch water gauge pressure, but with large deliveries, will be necessary in most places, and this does away with high chimneys, but occasionally sufficient induced draught will be available.

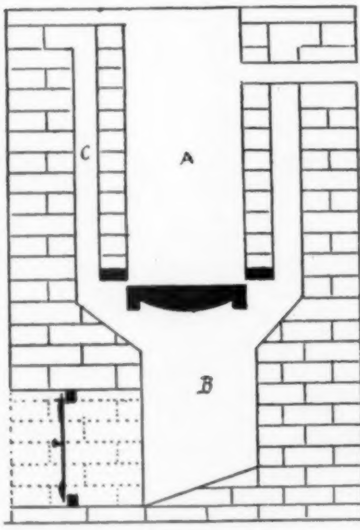


FIG. 1—SINGLE POT FURNACE

For practical working wrought-iron, for example, should only average about two hours in melting, but this very much will depend on the hours worked. Better results obtained in a double-shift day of sixteen or eighteen hours than in a ten-hour single shift, on account of the gradual heating of the furnaces for the first melt, and the absorption of heat by the walls of the furnace at first. On an average it will be found that from 1¼ cwt. to 1½ cwt. of coke is needed per 1 cwt. of metal melted in a four-pot furnace, and rather more for single pot furnaces for wrought iron and the refractory metals, assuming that really good furnace coke be used, although with poor samples of coke this average will be much increased, while gas coke is quite useless for the purpose. Dust and very small coke is useless for high temperature work, and usually nothing passing a 1 in. mesh or being held by a 3 in. mesh screen should be used in the fire, as the size indicated would probable give the greatest effective combustion surface for the production of heat. Coke high in either sulphur or ash should be avoided as the sulphur destroys the crucibles, especially those made of plumbago, and ash reduces the effective heating surface of the fuel as well as causing trouble in the flues.

As the heat is wanted in the furnace, the size of the exit flue for the burnt gases should be restricted to what is really sufficient. For a single-pot furnace an opening from 6 in. to 9 in. by 3 in. is usually enough, the object being not to have a rapid draught, but one in which the fuel produces the greatest heat which is retained in and around the crucible as long as possible. To secure this, plenty of oxygen must be supplied, but the air must pass through the bed of fuel slowly enough to enable the oxygen to be abstracted, a point often overlooked in working. The air sent in should be pre-heated, and to do this the waste heat from the furnace is utilized, while in some cases the walls of the furnace are kept comparatively cool by passing the air over the outside in its passage to the ashpit, where, of course, its active use commences.

In these furnaces the firebars should be thin and deep so that they remain as cool as possible; but as large an area as can be provided must be allowed for the admission of air. The crucibles are placed on stands of refractory material, so that they shall be in the same position and stand without moving when fresh fuel is added. If arched stands are used they do not seriously obstruct the admission of air, while in many cases their use ensures the greatest heat round the crucibles, as opposed to the generally high temperature of the whole furnace.

Single-pot furnaces are built in pairs, one fan serving the two, the general arrangement of both furnace and air supply being shown in the sections given in Figs. 1 and 2, but these can be modified to meet any necessary requirements, the actual furnace chamber may, however, very well be of firebricks of single thickness well put together and supported against spreading by means of iron supports as shown in Fig. 4, these being of either wrought- or cast-iron. The air passing over the outer sides of the furnace becomes heated while keeping the brickwork comparatively cool, and in this way there are fewer repairs to be considered. The walls of the furnace are supported on cast-iron bearers, and there is little chance of these failing as they remain cool enough for practical working, unless they are directly in contact with the fire, a point that can easily be dealt with if a little thought is given

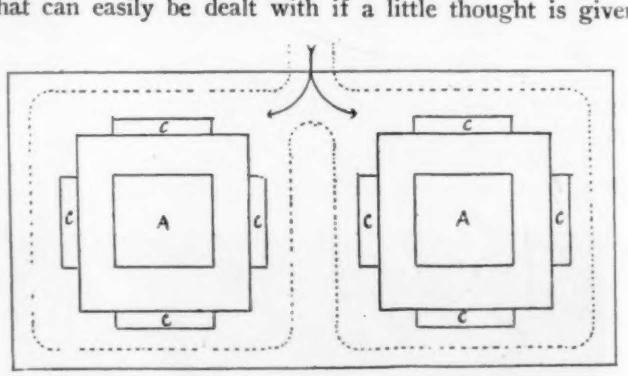


FIG. 2—PAIR OF SINGLE POT FURNACES

while making out the drawings for the furnaces. In Fig. 2 the air-distributing channels are shown by dotted lines.

In the case of four-pot furnaces—which should also be in pairs—it is more usual to build solidly and have a metal heating chamber for the air at the back, the flues descending as shown in Fig. 3, and the waste heat largely passing into the air in the pre-heating chamber. There are

many modifications of this general idea, and generally the local surroundings have to be considered when actually designing a furnace for each particular position to be dealt with. If preferred, there is no reason why the thin furnace walls should not be used for pre-heating as shown in Fig. 7, the chief thing being that more support against spreading is needed, as the greater the area of the walls the weaker they become. The general idea of the wall supports is given in Fig. 4, these being inserted in the outer walls of stock bricks and nearly touching the fire-brick inner furnace when cold. A space of about 3/16 in. is allowed for expansion, this being roughly what may be expected. In cases where this form of pre-heating is adopted, the same general outlines of working would be

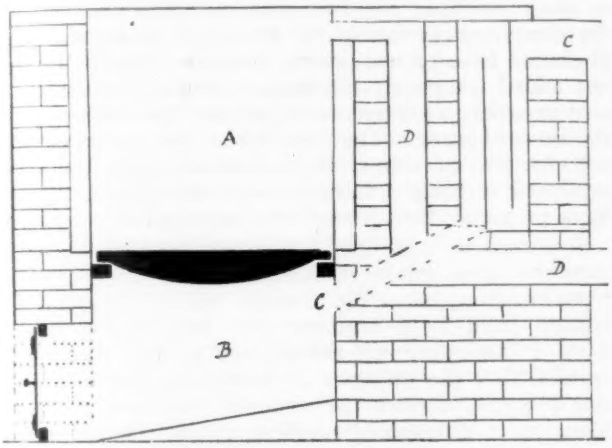


FIG. 3—ARRANGEMENT OF FLUES

as in Figs. 1 and 2, but in each case drawings must be got out for the particular position.

In the illustrations A represents the furnace. B the ash-pit, C the air-supply passages, and D the flue.

The lifting of the crucibles is always a hot job, and for this reason either tongs manipulated by chain tackle hung from the roof over each furnace or a travelling arrangement for lifting is best, the last possibly costing least where the furnaces can be arranged in line. Usually a girder from side to side of the building over the center of the furnaces, and carrying a travelling hook from which the block and chain and tongs are suspended, is as handy a thing as can be used, and about 8 ft. above the furnaces gives plenty of room for manipulation.

In all cases the ashpit under the furnaces is closely enclosed, doors being provided for the removal of ashes necessarily; but the pit in front of the furnaces does not require a grating. Close plates are as useful as anything so long as they are smooth and firm to walk

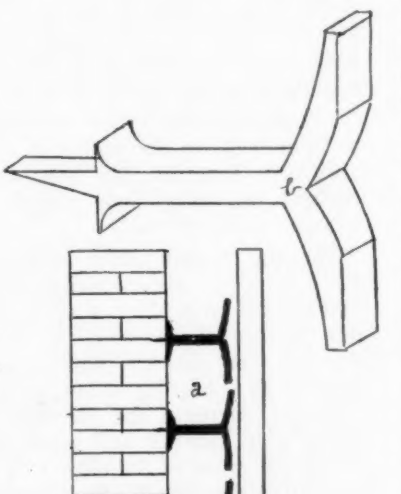


FIG. 4—WALL SUPPORTS

on, cast plates of sufficient strength being as good as any. There must be means of getting into the pit for removing ashes and other work, this being arranged as is most convenient with each furnace. In all cases the movable covers must fit safely and not be too heavy for easy handling. These details depend very much on local conveniences, however, and are often as good when made of rough materials as when especially made at a large expense.

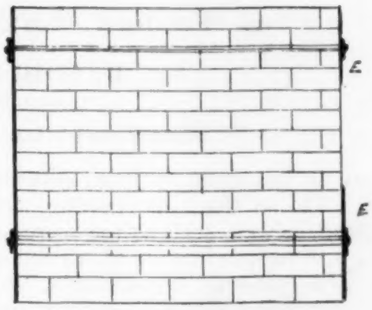


FIG. 5—TIE RODS

It is not a bad plan to plate the fronts of furnaces of this kind, having tie-rods passing through iron tubes to large plates at the back as at E in Fig. 5. As the outer walls and other brickwork is of ordinary bricks where not exposed directly to the fire, and as ordinary mortar is used, the heat affects the work as there is rarely time for the silicification of the mortar, and while standing well enough if left alone, a chance blow will dislodge and damage brickwork of this kind very easily. In the case of brickwork in contact with the fire, the heat frits the fire-clay and causes it to become solid; but the comparatively low heat reaching the outer walls tends to more or less disintegration as nothing will fuse at so low a temperature.

Roughly, anywhere up to 3,000 degrees F. will be needed from time to time, and to stand this heat only the best firebricks can be depended on, while it is quite possible that in some cases specially refractory linings might be necessary.

The mouth of the exit flue always cuts away badly, even in the comparatively low temperature of an ordinary brass furnace when it is worked to its fullest capacity, and it may be profitable to use chromite or bauxite bricks at a particular spot, as an unlimited flue opening is a source of waste in addition to reducing the heating capacity of the furnace. In some cases a good silica brick is worth using for the whole of the furnace exposed to direct heat; but with these things considerable care is necessary as to their source, because a small addition of some material acting as a flux will often reduce the refractory value of a highly-priced brick to that of the ordinary firebrick. In filling up the surface of furnaces where worn, finely ground ganister as used for steel-furnace work, is very suitable, if put on to clean brick; but if slag or clinker underlies the filling, the whole mass fuses and runs away in a short time. This makes a mess difficult to deal with.

FIG. 6—CRUCIBLE

In all cases in arranging furnaces for the purpose of melting metals needing high temperature, it has to be remembered that barrel-shaped crucibles roughly of the form shown by Fig. 6 will be used, as these allow of the quicker penetration of heat. These are smaller in diameter than crucibles used for brass-melting. Carbon may also have to be kept out of the metal, as it may be detrimental. This causes careful adjustment of the draught to be necessary, the furnace thus having to be constructed to fit the crucibles in all cases.

The Production of White Bearing Metals and Tin Solders from Scrap Metals

Methods of Purifying and Mixing Scrap to Produce Marketable Alloys—Part I.

By EDMUND R. THEWS
Consulting Engineer

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

Since 1922 the price of tin has gone up from $600 to above $1,400 per ton in 1926 so that, disregarding entirely the other price raising factors, such as the increase of lead prices, etc., the costs of production of all white metal alloys rich in tin have gone up considerably. In view of this fact it is not surprising that the recovery and remelting of suitable scrap alloys for the production of high grade white metal alloys is rapidly growing in importance.

The production of all alloys rich in tin and relatively free from impurities necessitates the employment of raw materials which, besides being free from zinc and as poor in iron as possible, must contain the amounts of copper and antimony required for the particular purposes in question. However, on account of the relatively high price of these better grades of scrap alloys, processes have gradually been developed for remelting and treating old and comparatively impure metal alloys of suitable composition for the direct or indirect production of the alloys desired, a development particularly characteristic of Continental conditions, where the immensely large amounts of war scrap available and the impoverishment of the European nations tended to force the metal industries to pay particular attention to this branch of metallurgy.

It is quite natural, of course, that in spite of the relatively large differences in composition prevailing between the various main groups of white metals, such as the bearing metals and tin solders, there are certain uniform methods of preparation and production yielding standard alloys relatively poor in antimony and copper and practically free from zinc, which by alloying with other suitable alloys and metals may be converted into the individual alloys required. Indeed, in manufacturing tin solder and white bearing metals from old metal scrap, conditions are such that both groups of alloys may be produced side by side, that is to say, the scrap materials are treated so as to separate alloys comparatively rich in copper and antimony and poorer in tin, finally obtaining a high grade of tin alloy almost free of copper and correspondingly poor in antimony, the best alloy of this kind obtainable being the "tin alloy" generally known as base alloy to the producers of tin solders.

Before describing the various metallurgical treatments required, it may be necessary to point out the metallurgical and fundamental mechanical properties distinguishing the individual groups of alloys under consideration.

From a metallurgical point of view, tin solder and white bearing metals differ in but one basic feature determining all the other minor points of importance, their antimony and copper contents. While the composition and structure of soldering metals must be perfectly uniform, possessing all the strength, toughness, and elasticity required for maintaining the intimate contact betwen the solder and the articles soldered, bearing metals must also be very hard in order to bear up under the weight and the grinding stress of the shaft. Since a combination of these properties cannot possibly be obtained in a homogenous alloy, bearing metals must of necessity be heterogenous, consisting of a ground mass of plastic and ductile lead-tin alloy containing a net work of hard grains which in this case consist of the cuboids of the tin-antimony compound SnSb and the elongated crystals of the tin-copper compound $SnCu_3$. It should here be mentioned, however, that the copper is not added for purely mechanical reasons exclusively, but also in order to prevent segregation of the antimony from the tin-lead mass. The dentritic copper crystals containing 30-40% of copper crystallize out first, the crystals produced forming a lattice system throughout the whole mass of metal, thus preventing segregation of antimony.

It should be understood, however, that tin solders, not even the better grades of tinman's solder, are entirely free from antimony, since the common use of "Tin alloy" containing from 3.4% antimony will introduce as much as 2-3% of antimony into the finished solders. The general opinion that the presence of antimony makes the solder run sluggishly under the soldering tool and prevents its adhesion to galvanized surfaces, is not true of the ordinary good grade solders, although in the case of very poor varieties, such as Terne metal containing about 20% of tin, an antimony content of 2.5% might cause difficulty.

However, the lower the tin contents, the lower must of necessity be the antimony contents of the alloys if the solder has been made correctly, that is to say, by alloying good tin alloy (55% tin) with refined lead. In the case of Terne alloy, a tin alloy containing 3.5% antimony would lead to a final percentage of but 1.3% of antimony which does not appreciably deteriorate the soldering properties of the alloy. On the contrary, a few percent. of antimony are distinctly beneficial in improving the appearance of a solder, and an alloy containing, say, 45% of tin and 2% of antimony looks much better than a straight 50:50 solder.*

Excessively high antimony contents, that is to say, such of more than 3.5-4.0%, possess all the deteriorating influences above mentioned, besides decreasing appreciably the resistance of the solder towards corrosive influences.

Concerning the other undesirable constituents, little is to be said about the soldering alloys since, apart from the antimony contents, the base alloy employed (tin alloy) contain but very little copper and iron, and no zinc, arsenic, and sulphur.

Bearing metals differ from solders in this direction, since some of the impurities which would be altogether detrimental in solders, may be of good influence in bearing metals if present in sufficiently small amounts. Arsenic, for instance, which must under no condition be present in soldering alloys, will, if present in small percentages, increase the freedom of the metal from blow holes, give sharper and more homogenous castings, and refine the grain of the alloy. It also increases the fluidity, but diminishes the hardness and toughness of the bearing metal. Wherever arsenic is added intentionally, it is present in amounts ranging from 0.30 to 0.75%.

*Where lower antimony contents are considered necessary, it is possible to reduce them by one of the various processes developed for this purpose.

RAW MATERIAL

The raw material used for the production of tin solder and white bearing metals consist mainly of bearing metal scrap which may be had in all imaginable compositions, the most typical alloys being the following:—

TIN	ANTIMONY	LEAD	COPPER	ARSENIC
42	12.5	44	1.5	
45	15	37	3	
50	14.5	32.3	3.40	
75	5	15	5	
Cheaper alloys are:				
19	15.5	62	3	
24	12	61	2.5	

No attention has been paid to the bearing metal alloys very rich and very poor in tin.

Apart from this raw scrap material, ingot metal in all desired proportions may be bought from residue smelters where these are produced from white metal ashes and other metallic residues and which are usually freed from zinc and other harmful impurities most always present in the scrap. Looking at the proposition from an economical point of view, however, it is just this presence of impurities, which makes the art of remelting scrap alloys profitable. Good scrap, free from all components excepting the four main elements of bearing metal are in such a demand at all times that in view of the correspondingly high prices melting profits are rather low. The presence of impurities, such as zinc and sulfur, decrease considerably the market prices, since they are of no interest to the alloy market generally and depend upon the smelters for consumption. As a rule, all bearing metal scrap may be used for the production of bearing metal and solder if the material contains sufficiently large amounts of tin to permit of the production of tin solder. The only impurity to be guarded against is arsenic, since it is very difficult indeed remove this element from white metal alloys in reverberatory or melting pot without oxidizing a large amount of tin.

From a purely metallurgical point of view, the removal of all the common impurities of good grade bearing metal scrap does not offer extraordinary difficulties. It is well known that copper and, to some extent, antimony may be largely removed from the alloy by repeated segregation or eliquation, while zinc may be completely burned out by superheating and rabbling the metal a few minutes or by passing steam or air through the moderately heated alloy in a melting pot. Much more serious, however, is the economic side of the problem. The quantity and quality of the yield, the duration of the process, the kind and purity of the by-products obtained, and other minor, factors influence to a very high degree the efficiency of the process.

If bearing metal alone is to be produced, that is to say, if the bearing metal scrap bought is only to be freed of its impurities or, perhaps, its copper contents, the process is comparatively simple. Indeed, if the zinc and copper contents of the raw material are low, the percentages of copper present remaining below 2-3% and the zinc within about 0.1-0.15%, the entire process may be carried out in an ordinary melting pot plant.

Fig. 1 shows a melting pot plant suitable for this purpose. The melting pots should be made of steel, although in spite of the growing recognition of the excellent properties of this material, cast iron pots are almost exclusively used by the residue smelters. The advantages of the steel pot for melting white metal alloys are the following:—

(1) Steel is much less attacked by the hot alloys and by the corrosive influences of the air or chemical substances used for the purification of the alloys.

(2) It is appreciably more resistant against the thermic and corrosive influences of the firing gases.

(3) On account of the comparatively high resistance, the walls of the steel pots may be made much thinner and the weight of these is correspondingly decreased.

On account of the lighter weight of the thinner walled steel pots the difference in price is but slight.

If the melting pots are to be made of cast iron, certain iron mixture should be specified, the best of which has been found to be the following:—

2.5% graphitic Carbon
0.5-0.8% combined Carbon
1.5-2.5% Manganese
2.0% Silicon

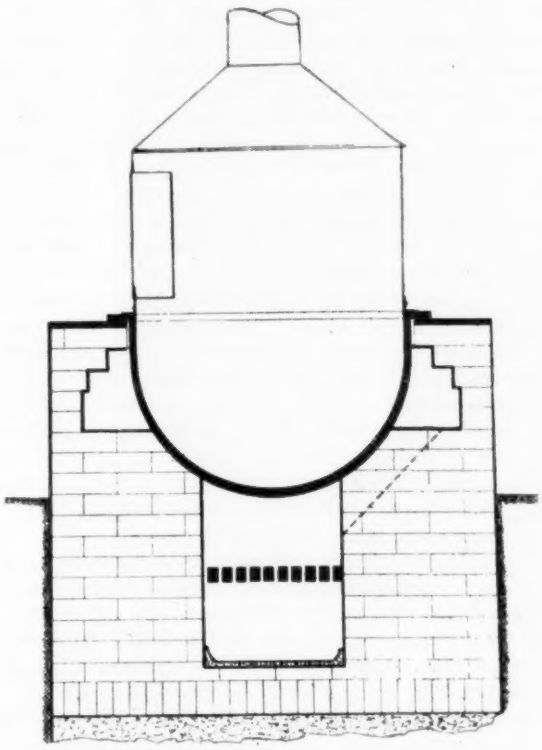


FIG. 1—MELTING POT PLANT

Sulphur and phosphorus should be present in the smallest possible amounts.

In order to improve the resistance of grey iron to the corrosive action of the products of combustion as well as the internal stresses arising from the heating, haematite mixtures containing about 30% of haematite, have been largely used with success. Grey iron pots should be poured "bottom down" so as to prevent gas bubbles from gathering in the bottom and weakening it. At a depth of 25 inches and an upper diameter of 35 inches, the pot will hold about 1½ tons of white metal alloy. The pot rests upon a cast iron plate designated to carry the weight of the filled pot as well as to prevent the entrance of spilled metal into the brickwork. The outside of the brickwork consists of ordinary bricks, while the lining should be made of high grade fireclay bricks.

Very little attention is usually paid to the exact proportioning of the various parts of the masonry and the firing of the melting pot plant. In order to get the most out of the calorific value of the fuel, the products of combustion must not be led directly into the flue, but should be made to rotate around the walls of the pot once or twice. With smelting pots up to 4-5 tons capacity, one channel suffices, larger units should be supplied with two.

To prevent undue burning of the bottom of the melting pots, the distance between bottom and fire grate should be at least 12 inches, although the exact measurements are

mainly determined by the kind of fuel employed. The softer the fuel, the nearer the grates should be the bottom of the pot. If gaseous fuel is used, the burner must be placed proportionately deep and somewhat inclined so as to prevent the tip of the flame from reaching any part of the melting pot. Forced draught and secondary air supply should under no condition be applied.

REMOVAL OF COPPER IN THE MELTING POT

If the raw material purchased contains no zinc, and copper only is to be removed, the scrap is melted down in the pot until this is filled up to about 5 inches from the rim, firing discontinued, and the melt allowed to cool off gradually. With decreasing temperatures, a dark viscous dross separates out on the surface of the metal which gradually hardens. As soon as this layer has reached a thickness of about ½ inch, it is taken off with perforated ladles which permit the liquid metal to drain off leaving a heavy, dry mass containing 20 to 30% of copper. If very much copper was present in the scrap this treatment must be repeated once or twice. By this process, the copper contents of bearing metals may be reduced to as low as 0.10% in the case of alloys low in tin, and to 0.15% if much tin is present.

The copper dross is further treated in a reverberatory furnace for the extraction of as much of the white metal as possible until, finally, a copper alloy containing 40-50% copper and not more than 3% of lead is obtained which may be used as base alloy in the production of standard white bearing metal containing 80% of tin, 15% of antimony and 5% of copper.

If it is desired for some special reason to lower the percentage of copper in the alloy still further, the "sulfurizing" treatment must be applied.

As usually practiced, sulfurizing is carried through by throwing a few pieces of sulfur sticks or a handful of flowers of sulfur onto the surface of the bath, stirring the metal vigorously until all the sulfur has burned off. It is clear that the efficiency of this process cannot be very high, since only a very small proportion of the fused sulfur and none of the volatilized material is actually used for sulfurization, and the most vigorous stirring cannot effect sufficient contact between all parts of the metal and the small amount of sulfur free to act on the copper.

Much better results are obtained by the following sulfurizing operation:—

The alloy is heated to a temperature of about 850°F and a few pieces of sulfur sticks contained in a sulfurizing box brought down as far as possible below the surface of the metal where it volatilizes, the vapors generated causing a thorough upheaval of the melt, thus assuring intimate contact of all parts of the metal with the sulphur vapors. A considerable portion of the copper present—though not all of it—combines with the sulphur, forming copper sulphide which rises to the surface and is removed together with the dross formed. (It is clear that this dross cannot be added to the pure copper dross produced by segregation, but that it must first be subjected to a desulphurizing treatment by steaming or by putting it through a blast furnace.)

The reactive power of the sulphur is often attempted to be improved by adding a few pieces of fresh potatoes to the sulphur in the sulphurizing box, the water vapor generated being supposed to intensify the sulphurizing action. While this idea is correct in theory, it is foolish to believe that the trifling amounts of moisture would have any influence on the treatment of several tons of metal. The only good thing about this potato trick is that it does not hurt the process, as is the case with very many other "tricks."

The only efficient way of intensifying the sulphurizing action is by the application of the steaming device described later.

The sulphurizing apparatus consists of a cylindrical or square sheet iron box, about 5 inches long and 3 inches wide, welded to an iron rod at least 7 feet long. The lid of the box, which should be turned downward, is perforated for the escape of the sulphur vapors.

Attention must here be called to the fact that at the temperatures prevailing in the lower parts of the pot the iron walls are exceedingly sensitive to the corrosive action of the sulphur vapors, so that these should not be allowed to touch the bottom of the pot. For this reason, the sulfur box should not be welded to the end of the rod, but about 4 or 5 inches further up, so that if the rod is supported on the bottom of the pot, the sulphur will not be able to penetrate down to the bottom.

Since in spite of careful working the upper parts of the walls of the pot will get into contact with sulphur vapors, care should be taken to protect these as far as possible by washing the pots at regular intervals with a concentrated solution of milk of lime. Still better protection is afforded if graphite is added to the milk of lime, the graphite flakes filling up the pores of the iron.

By this sulphurizing treatment the copper contents of white metal alloys poor in tin may be decreased to 0.05%, those of high grade alloys, to about 0.10%. It is impossible to carry this process further without incurring heavy losses of tin by oxidation.

This article will be continued in an early issue.—Ed.

Black Finish for Hardware

Q.—Please give me a formula for producing a dead black finish on builders' hardware. The finish I refer to is called "Old Iron." I am now using muriatic acid and arsenic, but this gives only a lustre finish and the fumes are very offensive. I use an electric current with this.

A.—A black finish that gives good results for your class of work is as follows:

Double nickel salts	8 oz.
Ammonium sulphocyanide	2 oz.
Zinc sulphate	1 oz.
Water	1 gal.

Use at room temperature and 1 volt pressure. If deposit is not black enough, add a very small amount of cyanide copper to the black nickel solution.

—O. J. Sizelove.

Copper Cleansing and Plating Solution

The following solution will clean and copper plate at the same time:

Water	1 gallon
Zinc cyanide	⅛ oz.
Copper cyanide	3 to 4 ozs.
Sodium cyanide	4 to 5 ozs.
A good metal cleaner	4 to 8 ozs.
Either bisulphide or hyposulphide of soda	⅛ oz.

This solution should be heated to 140 to 160 degrees F. Plate for 10 to 15 minutes. The plate produced can be buffed with a 14 or 16 inch buff.

The zinc cyanide addition is to make the solution softer; it will make the article plated look better as it can be buffed up.

—A. V. Re.

The Stain Spotting of Cast Metals

Progress Report—A Summary of Research from March 1 to June 30, 1928

By W. P. BARROWS

Research Associate of the American Electroplaters' Society at the Bureau of Standards

INTRODUCTION

Investigations and observations extending over a period of more than a year have proved that there are at least two types of spotting-out. The first, observed only on lacquered sulfide or "oxidized" finishes occurs in the form of "dendritic" (tree-like) crystals usually with a black or nearly black color. These have been designed as "crystal spots" and have formed the principal subject of previous reports.

The second type consists of irregular areas of various colors to which the term "stain spots" has been applied. Stain spots are observed most frequently on cast metals, but they may also appear on wrought metals whose structure has been rendered porous by distortion or by the action of various reagents. Although cast metals have been employed thus far in the experimental work, the information obtained is probably equally applicable to the stain spotting of wrought metals.

The brass, bronze and malleable or grey iron castings employed for experimental purposes were made at the plants, and before shipment to the Bureau of Standards were prepared in the usual manner up to the point where they would normally enter some solution. All castings were of a type known to give frequent trouble from stain spotting. In accordance with the usual practice, the bronze or brass castings were copper plated and oxidized; and the iron castings were brass plated. A tentative standard method of cleaning and plating was adopted for each type of material, and the effects of modifications of this procedure upon the tendency toward staining were observed.

Preliminary experimental work led to the following general conclusions:

(1) Stain spots may occur on either oxidized or unoxidized finishes. Crystal spots occur only on the finishes which contain sulphur such as the oxidized finishes or black nickel deposits.

(2) Stain spots occur on both lacquered and unlacquered specimens while crystal spots occur only on lacquered objects.

(3) Stain spots occur on both plated and unplated castings.

(4) Moisture in the surrounding atmosphere is necessary to produce stain spots. Specimens that were exposed for several weeks at zero humidity without spotting, spotted badly in a few hours upon removal to an atmosphere of 90 per cent humidity.

(5) Stain spots usually occur in a humid atmosphere in a few hours while crystal spots may not appear until weeks or months after finishing.

(6) Stain spots are usually due to pores in the casting, either present originally or produced by the action of various solutions. This conclusion is drawn from the frequent presence of a small dark spot in the center of each stain, and from the fact that in many cases stains reappear at the same points when the stained specimens are stripped and polished to a new metal surface and then replated and refinished. The stains frequently reappear at the same points after two or more refinishing operations. These observations confirm those made by Graham[1] and others.

(7) The stains are due to the presence of "hygroscopic" (moisture absorbent) compounds occluded or formed in the pores of the metal by the action of cleaning, plating, or coloring solutions.

(8) Either alkaline or acid compounds may cause stain spotting.

(9) Moisture in the atmosphere absorbed by salts in the pores of a metal may cause the salts to "creep" out over the surface producing a stain or in extreme cases, a crystallization of solid material on the surface of the object.

From these preliminary observations it is evident that the occurrence of stain spots might be prevented or at least reduced, by (1) eliminating pores from the castings, (2) preventing staining compounds from entering into or remaining in the pores, or (3) by excluding moisture from access to the pores after the articles are finished. Exploratory work has been done on all three of these possibilities. Certain encouraging results have been obtained, but no definite recommendations can be made until more extensive tests are conducted, and until observations are made over a longer period. The following statements represent indications and not conclusions, and are included in this report merely in order that those who have experienced difficulty with stain spotting, or who have tried these or other remedies may advise us as to whether their experience agrees with ours.

1—Reduction of Porosity of Castings.

It is at least possible that less porous castings might be made by changing the foundry conditions such as the composition or temperature of the molten metal, the design of the patterns, or the character of the molds. Experimental work on this subject must be conducted in a commercial foundry, as it is impractical to make such castings on a small scale. Specimens of cast iron parts received from one plant indicate that by a simple change in design, resulting in a thicker cross section, a marked decrease in porosity was produced. If confirmed by further observations, this result suggests a very practical solution of at least a part of the spotting-out problem.

2—Elimination or Exclusion of Salts from the Pores.

Attempts to fill the pores with some inert material, such as glycerine or lacquer, that might prevent the absorption of alkali compounds during the cleaning or plating processes, were unsuccessful.

Efforts to fill the pores with a neutral solution, such as a nickel bath, by first plating the castings with nickel before they entered an alkaline or cyanide solution did not result in any decrease in the spotting.

Attempts were made to introduce chromic acid into the pores of grey iron castings by treating them in boiling chromic acid (25 g/L, or 3.5 oz/gal) in the hope that

[1] Electroplaters' Review, March, 1927.

mainly determined by the kind of fuel employed. The softer the fuel, the nearer the grates should be the bottom of the pot. If gaseous fuel is used, the burner must be placed proportionately deep and somewhat inclined so as to prevent the tip of the flame from reaching any part of the melting pot. Forced draught and secondary air supply should under no condition be applied.

REMOVAL OF COPPER IN THE MELTING POT

If the raw material purchased contains no zinc, and copper only is to be removed, the scrap is melted down in the pot until this is filled up to about 5 inches from the rim, firing discontinued, and the melt allowed to cool off gradually. With decreasing temperatures, a dark viscous dross separates out on the surface of the metal which gradually hardens. As soon as this layer has reached a thickness of about ½ inch, it is taken off with perforated ladles which permit the liquid metal to drain off leaving a heavy, dry mass containing 20 to 30% of copper. If very much copper was present in the scrap this treatment must be repeated once or twice. By this process, the copper contents of bearing metals may be reduced to as low as 0.10% in the case of alloys low in tin, and to 0.15% if much tin is present.

The copper dross is further treated in a reverberatory furnace for the extraction of as much of the white metal as possible until, finally, a copper alloy containing 40-50% copper and not more than 3% of lead is obtained which may be used as base alloy in the production of standard white bearing metal containing 80% of tin, 15% of antimony and 5% of copper.

If it is desired for some special reason to lower the percentage of copper in the alloy still further, the "sulfurizing" treatment must be applied.

As usually practiced, sulfurizing is carried through by throwing a few pieces of sulfur sticks or a handful of flowers of sulfur onto the surface of the bath, stirring the metal vigorously until all the sulfur has burned off. It is clear that the efficiency of this process cannot be very high, since only a very small proportion of the fused sulfur and none of the volatilized material is actually used for sulfurization, and the most vigorous stirring cannot effect sufficient contact between all parts of the metal and the small amount of sulfur free to act on the copper.

Much better results are obtained by the following sulfurizing operation:—

The alloy is heated to a temperature of about 850°F and a few pieces of sulfur sticks contained in a sulfurizing box brought down as far as possible below the surface of the metal where it volatilizes, the vapors generated causing a thorough upheaval of the melt, thus assuring intimate contact of all parts of the metal with the sulphur vapors. A considerable portion of the copper present—though not all of it—combines with the sulphur, forming copper sulphide which rises to the surface and is removed together with the dross formed. (It is clear that this dross cannot be added to the pure copper dross produced by segregation, but that it must first be subjected to a desulphurizing treatment by steaming or by putting it through a blast furnace.)

The reactive power of the sulphur is often attempted to be improved by adding a few pieces of fresh potatoes to the sulphur in the sulphurizing box, the water vapor generated being supposed to intensify the sulphurizing action. While this idea is correct in theory, it is foolish to believe that the trifling amounts of moisture would have any influence on the treatment of several tons of metal. The only good thing about this potato trick is that it does not hurt the process, as is the case with very many other "tricks."

The only efficient way of intensifying the sulphurizing action is by the application of the steaming device described later.

The sulphurizing apparatus consists of a cylindrical or square sheet iron box, about 5 inches long and 3 inches wide, welded to an iron rod at least 7 feet long. The lid of the box, which should be turned downward, is perforated for the escape of the sulphur vapors.

Attention must here be called to the fact that at the temperatures prevailing in the lower parts of the pot the iron walls are exceedingly sensitive to the corrosive action of the sulphur vapors, so that these should not be allowed to touch the bottom of the pot. For this reason, the sulfur box should not be welded to the end of the rod, but about 4 or 5 inches further up, so that if the rod is supported on the bottom of the pot, the sulphur will not be able to penetrate down to the bottom.

Since in spite of careful working the upper parts of the walls of the pot will get into contact with sulphur vapors, care should be taken to protect these as far as possible by washing the pots at regular intervals with a concentrated solution of milk of lime. Still better protection is afforded if graphite is added to the milk of lime, the graphite flakes filling up the pores of the iron.

By this sulphurizing treatment the copper contents of white metal alloys poor in tin may be decreased to 0.05%, those of high grade alloys, to about 0.10%. It is impossible to carry this process further without incurring heavy losses of tin by oxidation.

This article will be continued in an early issue.—Ed.

Black Finish for Hardware

Q.—Please give me a formula for producing a dead black finish on builders' hardware. The finish I refer to is called "Old Iron." I am now using muriatic acid and arsenic, but this gives only a lustre finish and the fumes are very offensive. I use an electric current with this.

A.—A black finish that gives good results for your class of work is as follows:

Double nickel salts	8 oz.
Ammonium sulphocyanide	2 oz.
Zinc sulphate	1 oz.
Water	1 gal.

Use at room temperature and 1 volt pressure. If deposit is not black enough, add a very small amount of cyanide copper to the black nickel solution.

—O. J. SIZELOVE.

Copper Cleansing and Plating Solution

The following solution will clean and copper plate at the same time:

Water	1 gallon
Zinc cyanide	⅛ oz.
Copper cyanide	3 to 4 ozs.
Sodium cyanide	4 to 5 ozs.
A good metal cleaner	4 to 8 ozs.
Either bisulphide or hyposulphide of soda	⅛ oz.

This solution should be heated to 140 to 160 degrees F. Plate for 10 to 15 minutes. The plate produced can be buffed with a 14 or 16 inch buff.

The zinc cyanide addition is to make the solution softer; it will make the article plated look better as it can be buffed up.

—A. V. RE.

The Stain Spotting of Cast Metals

Progress Report—A Summary of Research from March 1 to June 30, 1928

By W. P. BARROWS

Research Associate of the American Electroplaters' Society at the Bureau of Standards

INTRODUCTION

Investigations and observations extending over a period of more than a year have proved that there are at least two types of spotting-out. The first, observed only on lacquered sulfide or "oxidized" finishes occurs in the form of "dendritic" (tree-like) crystals usually with a black or nearly black color. These have been designed as "crystal spots" and have formed the principal subject of previous reports.

The second type consists of irregular areas of various colors to which the term "stain spots" has been applied. Stain spots are observed most frequently on cast metals, but they may also appear on wrought metals whose structure has been rendered porous by distortion or by the action of various reagents. Although cast metals have been employed thus far in the experimental work, the information obtained is probably equally applicable to the stain spotting of wrought metals.

The brass, bronze and malleable or grey iron castings employed for experimental purposes were made at the plants, and before shipment to the Bureau of Standards were prepared in the usual manner up to the point where they would normally enter some solution. All castings were of a type known to give frequent trouble from stain spotting. In accordance with the usual practice, the bronze or brass castings were copper plated and oxidized; and the iron castings were brass plated. A tentative standard method of cleaning and plating was adopted for each type of material, and the effects of modifications of this procedure upon the tendency toward staining were observed.

Preliminary experimental work led to the following general conclusions:

(1) Stain spots may occur on either oxidized or unoxidized finishes. Crystal spots occur only on the finishes which contain sulphur such as the oxidized finishes or black nickel deposits.

(2) Stain spots occur on both lacquered and unlacquered specimens while crystal spots occur only on lacquered objects.

(3) Stain spots occur on both plated and unplated castings.

(4) Moisture in the surrounding atmosphere is necessary to produce stain spots. Specimens that were exposed for several weeks at zero humidity without spotting, spotted badly in a few hours upon removal to an atmosphere of 90 per cent humidity.

(5) Stain spots usually occur in a humid atmosphere in a few hours while crystal spots may not appear until weeks or months after finishing.

(6) Stain spots are usually due to pores in the casting, either present originally or produced by the action of various solutions. This conclusion is drawn from the frequent presence of a small dark spot in the center of each stain, and from the fact that in many cases stains reappear at the same points when the stained specimens are stripped and polished to a new metal surface and then replated and refinished. The stains frequently reappear at the same points after two or more refinishing operations. These observations confirm those made by Graham[1] and others.

(7) The stains are due to the presence of "hygroscopic" (moisture absorbent) compounds occluded or formed in the pores of the metal by the action of cleaning, plating, or coloring solutions.

(8) Either alkaline or acid compounds may cause stain spotting.

(9) Moisture in the atmosphere absorbed by salts in the pores of a metal may cause the salts to "creep" out over the surface producing a stain or in extreme cases, a crystallization of solid material on the surface of the object.

From these preliminary observations it is evident that the occurrence of stain spots might be prevented or at least reduced, by (1) eliminating pores from the castings, (2) preventing staining compounds from entering into or remaining in the pores, or (3) by excluding moisture from access to the pores after the articles are finished. Exploratory work has been done on all three of these possibilities. Certain encouraging results have been obtained, but no definite recommendations can be made until more extensive tests are conducted, and until observations are made over a longer period. The following statements represent indications and not conclusions, and are included in this report merely in order that those who have experienced difficulty with stain spotting, or who have tried these or other remedies may advise us as to whether their experience agrees with ours.

1—Reduction of Porosity of Castings.

It is at least possible that less porous castings might be made by changing the foundry conditions such as the composition or temperature of the molten metal, the design of the patterns, or the character of the molds. Experimental work on this subject must be conducted in a commercial foundry, as it is impractical to make such castings on a small scale. Specimens of cast iron parts received from one plant indicate that by a simple change in design, resulting in a thicker cross section, a marked decrease in porosity was produced. If confirmed by further observations, this result suggests a very practical solution of at least a part of the spotting-out problem.

2—Elimination or Exclusion of Salts from the Pores.

Attempts to fill the pores with some inert material, such as glycerine or lacquer, that might prevent the absorption of alkali compounds during the cleaning or plating processes, were unsuccessful.

Efforts to fill the pores with a neutral solution, such as a nickel bath, by first plating the castings with nickel before they entered an alkaline or cyanide solution did not result in any decrease in the spotting.

Attempts were made to introduce chromic acid into the pores of grey iron castings by treating them in boiling chromic acid (25 g/L, or 3.5 oz/gal) in the hope that

[1] Electroplaters' Review, March, 1927.

this would neutralize any alkali that might enter the pores during the subsequent cleaning or brass plating process. No improvement was observed.

Treatment of brass plated cast iron with acetic acid (50 g/L or 8 oz/gal); with chromic acid (25 g/L or 3.5 oz/gal); with hydrochloric, sulfuric or nitric acid (30 g/L or 4 oz/gal); with cream of tartar (6 and 60 g/L or 0.8 and 8 oz/gal); followed in each case by thorough rinsing; failed to produce any decrease in the spotting.

As all observations indicated that the stains on plated metals are due largely to hygroscopic compounds of sodium or potassium, the elimination of such compounds from the cleaning, plating and coloring solutions seems desirable. That such substitutions are sometimes practicable and beneficial is indicated by the report made to us by E. R. Canning of Birmingham, Eng., that less staining on oxidized brass is encountered, if the metal is plated in an acid copper bath and then colored with ammonium sulfide. This observation was confirmed in our experiments, provided no alkaline cleaner was used prior to the acid copper plating.

The substitution of other methods of cleaning, such as organic solvents or pumice scrubbing, instead of the alkaline cleaners, is effective in reducing spotting, but is not very practicable. Extensive work would be required to develop simple, effective methods of cleaning that do not involve any sodium or potassium compounds. It would be still more difficult, if at all feasible, to develop brass plating solutions that do not contain sodium or potassium compounds.

3—Exclusion of Moisture from Access to the Finished Surfaces.

If it were feasible to keep the plated articles in a practically dry atmosphere no strain spotting would occur. This is of course not practicable, though it is often feasible to avoid storage of such products in rooms with high humidity.

It is therefore necessary to depend upon some coating to exclude the moisture from the pores. Experience with other applications of lacquers have shown that lacquers containing phenol condensation products, such as Bakelite lacquer, are more nearly imperious to moisture than are the nitro-cellulose lacquers. Our experiments up to this time have shown that the tendency toward spotting out is greatly reduced by substitution of Bakelite lacquer for the nitro-cellulose lacquer. The improvement is most marked on brass castings in which the pores are less numerous and more isolated than in cast iron. Porous iron castings are likely to absorb so much alkali that it attacks and destroys both types of lacquer coating. Even if more extensive observations confirm the advantages of Bakelite, it will still be necessary to take every precaution to reduce the porosity and the absorption of alkaline compounds in the pores.

Further experiments will be made upon the possible improvement of lacquers, either by changes in their compositions, or by certain treatments subsequent to the lacquering.

It is at least evident that there is no panacea for strain spotting, though it can apparently be decreased by suitable precautions.

Smut Green and Black

Q.—We would greatly appreciate your advising us of a dip solution with which we would be able to put a smut green on brass and a smut black on nickel silver. What we mean by a dip solution is that there will be no electrical contact. The size of the boxes we are to color is 6 in. x 3½ in.

A.—A smut black can be obtained on nickel silver in the following solution used as a dip:

Muriatic acid	1 gal.
White arsenic	8 oz.
Tellurium oxide	1/64 oz.

Use cold and immerse work in solution until smut is produced. If smut is too soft, reduce the tellurium oxide.

The only method that we are familiar with to produce a smut green on brass without the current is by the use of pigment colors. Select any green color ground in japan the shade of which is desired and thin with turpentine; paint on work and, when dry, relieve with rag or piece of felt moistened with turpentine.

—O. J. Sizelove.

Nickel Plating Old Pewter

Q.—We have some pewter articles to nickel plate. Our plater is unable to get a plate on these articles. Kindly give us the process of nickel plating pewter.

A.—We presume that the pewter articles you wish to nickel plate are old, as you should have no trouble plating new work. Pickle the work in hot muriatic acid, then scratch brush or pumice and polish on rag wheel with tripoli. Remove tripoli with gasoline, clean in mild alkaline cleaner, cyanide dip, then strike in cyanide copper solution for a few minutes before nickel plating, or plate direct in nickel solution.

—O. J. Sizelove.

Tin and Lead Plating

Q.—Kindly give us what you consider the best formulas for tin and lead plating.

A.—Formula for tin solution:

Sodium stannate	28 ozs.
White oxide tin	2 ozs.
Water	1 gal.

Use ⅛ oz. starch for brightener. Dissolve starch in warm water. Use solution at 140°F.; 2 to 5 volts. Pure tin anodes are used. Use one-half tin anodes and one-half iron anodes.

Formula for lead solution:

Basic carbonate lead	20 ozs.
50° hydrofluoric acid	32 ozs.
Boric acid	14 ozs.
Glue	1/200 oz.
Water	1 gal.

In preparing the bath, the hydrofluoric acid is placed in a lead-lined or hard rubber tank and the boric acid is added, a small amount at a time. When all the boric acid has been added, the solution is allowed to cool and the lead carbonate, in the form of a paste made with water, is added. Solution is allowed to settle, siphoned off, and placed in the plating tank, which should be of wood and lined with pitch. The glue is added in the form of a solution with water. Use 10 to 20 amperes per square foot; 4 to 6 volts. Mechanical agitation is essential.

—O. J. Sizelove.

Chromium Plating Solution

In the previous issue we published on page 353 the Bureau of Standards' chromium plating solution formula under the above title. This formula gave 3 oz. sulphuric acid as one of the factors. This figure was erroneous and should have been three-tenths (.3) ounces.—Ed.

The Manufacture of Steel Measuring Tape

How the Graduations on Steel Tape Are Made by the Transfer Etching Process

By FRANKLIN W. HOBBS

Expert Tape Maker

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

The manufacture of steel measuring tape is a transfer acid etching process, and consists briefly in filling the etched surface of a standard plate with an acid resisting paste, transferring it to etching tissue, and thence to the blank steel line after which the line is immersed in an acid bath which eats away the exposed parts leaving the figures and lines in relief.

The required equipment is as follows:

Transfer plates, one for each foot of line.
Roll presses, one for each print maker.
Plate tables.
Paste pots.
Print trimmers.
Laying on tables.
Wet and dry rolls.
Reels.
Reel stands.
Tanks for gasoline.
Lime, acid, soda, water, and sand bath.
Spools.
Hand winders.
Single line bands.

In order that an intelligent idea may be gained it will be necessary to describe each unit in detail. The plates are of steel, each having etched into its polished surface eight lines of graduations and figures, the first plate being eight lines of 0 to 1'; the second plate eight lines of 1' to 2' and so on. The presses consist of an iron table arranged to move forward and back under a felt covered iron roll, the operation accomplished by a hand lever. The plate table is simply a firm surface on which to place the plate when filling and having room at the side for a marble slab on which the melted paste is poured. The paste pots may be of iron with water jacket and means for heating, the print trimmers are not unlike a photographer's print trimmer, with guide and shear at the side, operated preferably by a foot lever. Print racks or lines of steel pegs are arranged on the wall, each to hold a certain section of prints. The laying-on benches are very important as to detail and construction as they must be perfectly straight and true at all times; made from thoroughly seasoned hard wood, supported by pipe standards with threaded flanges on floor and under bench. The top is fitted with a series of brass plates in which five grooves have been planed, each groove being the exact width and depth of the steel to be etched. The spacing of the grooves must exactly coincide with the standard plates. These are placed end to end and screwed firmly to the bench so that there are five perfectly straight grooves the length of the bench. Means are provided at each end of the bench for securing the lines with set screws, a ten pound weight being hung to each before securing the last end. The fifth groove is, of course, for the master or standard line.

The reels are made from "acid bronze," with a shaft with crank at one end and two hubs with radials, mounted at either end of shaft leaving spaces for bearings. Strips run from each radial at one end to the corresponding radial at the opposite end. These strips have notches along their outer edges somewhat wider at the tip than the tape steel is wide.

The reel stands are frames of wood mounted on trucks for convenience in moving about, and having two uprights to support the reels.

The various tanks need no description as they are of the usual construction, each being made suitable for the solution it is to contain. The sizes are all the same and suited to the length and diameter of the reels which must rest in bearings on ends of tanks. Power shafts are fitted to engage the cranks and keep the reels in motion in the various baths.

A series of cleaning and oiling blocks are distributed along a bench. These are like small boxes, open at two sides and having hinged covers with catches. They are stuffed with cotton waste, No. 1 having caustic soda solution added and ground pumice stone; No. 2 warm water; No. 3 dry pumice; No. 4 plain, and No. 5 oil. The spools are of iron grooved to the width of the steel line, as deep as desired and made to mount on a spindle which winds the completed line from the reel, through the blocks into the spool.

The hand winder consists of an iron disc somewhat larger than a tape case, mounted on a spindle which extends 3/8" through the disc, slotted to engage end of tape line. The spindle is geared to a hand crank and the whole mounted in a frame secured to a table.

The hoops are made by riveting up pieces of tape stock, and sizes to hold single tape lines for convenience in handling before assembly.

The wet and dry print rolls are of felt about two inches in diameter and four inches long, mounted in a frame and handled like a photographer's squeegee roll.

The transformation of a piece of plain .008" x 3/8" steel into a measuring tape line with clean sharp lines and figures deeply cut and correctly placed requires knowledge and experience and the novice is bound to meet with many disappointments.

I shall explain the operations in detail and call attention to the most likely causes of failure. An important detail is the composition of the paste and the following is a good one:

Pure beeswax, 1 lb.
Refined lamp black, 2 ozs.
Turpentine, 1 pt.
Venice turpentine, 2½ ozs.

Melt these together and stir thoroughly. A portion is poured on the marble slab and allowed to cool. Then with a spatula a small piece of the paste is taken and holding the handle with one hand and the end of the blade with the other, the upper edge canted toward the operator and drawn toward him, with two or three strokes the paste is forced into the etched surface of the plate. Now the upper edge of the knife is turned away from the operator and with two or three more strokes the paste is removed from the surface. This operation takes much practice and when one once gets the hang of just the right curve and sweep of the knife that is required, it can

be done swiftly. A sheet of transfer tissue is now laid upon the plate, placed on the press table and by the hand lever carried under the roll and back, which forces the paper into close contact with the plate. Now with another motion that requires practice the paper is caught by a corner with thumb and finger and peeled from the plate, when if everything has gone well the lines and figures will be formed in sharp relief on the paper by the paste which is now transferred from the plate. The print is hung on its proper peg and the operation repeated for as many prints as are desired from that plate, when it is washed and put in its proper place and the next plate brought into use.

Next, the prints are trimmed so that each piece has four lines of figures and graduations with the paper cut close to the edge. Now have the steel cut to the required lengths, punched at the ends, soaked in gasoline and cleaned by drawing with cotton waste saturated with gas followed by another handful of waste and lime. The lines are stretched in the grooves on the laying-on bench and secured with the set screws. Four or five girls can lay on and each one takes prints for the section which she is to do and places them at a convenient place on the bench. Number one starts by placing print 0 to 1' face down on the steel, guided by the paste graduations which show through the tissue she places at the ends of the graduation lines exactly at the edge of the blank steel and so as to exactly coincide with the graduations on the master tape. She pats it carefully just so it sticks in position. When the prints are all on, the dry rolls are run over them to make positive contact between print and steel. Here again experience and skill are required. Sometimes the rolling is repeated, depending upon conditions. If the temperature is below normal they will require more or harder rolling else the paste will lift with the print. On the other hand if the temperature is above normal too much or too heavy rolling will result in the paste being spread, causing broad uneven lines on the finished tape. An experienced girl can judge by touching the prints with the tips of her fingers as they lie face up on the bench, just about how much rolling that particular batch will require for best results. After the dry rolling, warm water is run on from a sponge followed by wet rolling which softens the paper so that it is lifted off when we have again transferred the paste, this time to the steel. Now the set screws are loosened and the lines are layed to one side, being careful to handle them by the ends. Another batch is inserted in the grooves and the operation repeated until enough steel is ready to fill the reels. The stand supporting a reel is brought into position at the end of the table, a line attached, then with one operator guiding the line into the notches, another at the crank and the third keeping the other end clear, the reel is filled. Ends of lines are joined by tubular rivets and the last end is made fast to the reel with a small wire.

Now the trucks laden with steel filled reels are run to the etching room. Here the first operation is to clean the steel of possible finger marks without disturbing the paste. This is accomplished by a twenty minute run in the lime tank in a solution consisting of air slaked lime and water. Next follow with a rinse in clear water, then a twenty minute run in the etching tank in a ten per cent solution of nitric acid. Next comes a run in strong caustic soda solution which removes the paste; now in the sand bath consisting of caustic soda, water, and enough sand so that there will be mechanical action to remove the oxide. From here it goes to a stand and is run through the cleaning and oiling blocks previously described, into spools.

The spool is next mounted on a spindle where the line is unreeled by hand and inspected for defects, broken off close to the joints, the end inserted in the hand winder. With a hoop, held over the line against the disc the line is whisked into the hoop, removed, patted on the table causing it to backlash and tighten in the hoop, when it is ready to go to the assembly room.

Inspection before removing from the benches sometimes shows where lines or parts of lines have lifted in which case they are supplied with a pencil brush, and paste reduced to working consistency with turpentine.

It is found necessary sometimes to make slight additions to the paste, as for instance, a batch several days old may be too hard, requiring thinning. Too much thinning will result in its failing to lift clean from the plate, which means a ragged print.

Spotting Out on Brass Plate

Q.—We are having trouble with spotting out on brass plated buckles, and are sending you a sample of a spotted buckle, as well as of the solution we use. Can you tell us how to prevent the spotting?

A.—Your trouble is not due so much to the condition of the brass solution as to the condition of the work that is being plated and the atmospheric conditions. The sample buckle, if examined closely where brown spots appear, is porous; it is full of small holes. During plating operations these small holes become filled with the plating solution, all of which is not removed in the drying operation, and later on this is brought to the surface by the condition of the atmosphere and it appears as brown spots. These spots appear mostly when the humidity of the atmosphere is high, especially at this time of the year. The sure way to eliminate this trouble is to do away with these small pores. This being impossible sometimes, you should remove as much of the solution as possible from these small holes before final finishing. This may be accomplished to a certain extent by rinsing the work thoroughly after plating. Rinse in clean, cold and hot waters repeatedly. Another method is to place the articles in a temperature of 400° to 450° F. for several hours after plating and before final finishing. Still another suggestion is to use a rinse containing 2 ozs. of cream of tartar per gallon of water. Let the work remain in this rinse for 10 to 15 minutes, then dry by passing work through cold and hot waters several times.

—O. J. Sizelove.

Black Deposit on Steel

To the Editor of The Metal Industry:

In reference to Problem 3,762, published in your July issue, I would suggest that the following solution be used:

Nitrate of lead	12 ozs.
Nitrate of ammonia	8 ozs.
Water	1 gallon

This should be heated to 120°F. Use lead anodes and reverse current. A black strike will be obtained in 1 to 2 minutes. The work should finally be coated with a good grade of lacquer.

—A. V. Re.

THE METAL INDUSTRY

With Which Are Incorporated
THE ALUMINUM WORLD, COPPER and BRASS, THE BRASS FOUNDER and FINISHER
THE ELECTRO-PLATERS' REVIEW

Member of Audit Bureau of Circulations and The Associated Business Papers

Published Monthly—Copyright 1928 by THE METAL INDUSTRY PUBLISHING COMPANY

Entered February 10, 1903, at New York, N. Y., as second class matter under Act of Congress March 3, 1879

SUBSCRIPTION PRICE, United States and Canada $1.00 Per Year. Other Countries $2.00 Per Year. SINGLE COPIES, 10 CENTS
Please Remit by Check or Money Order; Cash Should Be Registered

ADVERTISING RATES ON APPLICATION. FORMS CLOSE THE FIRST OF THE MONTH

Palmer H. Langdon .... Editor and Publisher
Adolph Bregman .... Managing Editor
Thomas A. Trumbour .... Business Manager
Evan J. Robinson .... Advertising Manager

ADDRESS ALL CORRESPONDENCE TO
THE METAL INDUSTRY, 99 JOHN STREET, NEW YORK
Telephone Number: Beekman 0404. Cable Address: Metalustry

Vol. 26 New York, September, 1928 No. 9

Contents

THE METAL INDUSTRY is regularly indexed in the Industrial Arts Index

Edition this Month, 6,000 Copies. Buyer's Guide—Advertising Page 79

Editorial

Metals Versus Metals

The idea of co-operative effort among competitors is spreading and nowhere more rapidly than in the metal industries. Trade associations are an old institution. At one time they fell into disrepute because of tactics employed by a few unrepresentative organizations, but these methods have gone out of style. There is, however, a legitimate purpose for trade organizations and they are indispensable.

In the metal trades during the past few years, trade associations have multiplied. The copper industry has added the Copper and Brass Research Association, the Copper Institute, and Copper Exporters, Inc., to the American Bureau of Metal Statistics. The zinc industry has its American Zinc Institute. The ingot manufacturers have just organized the Non-Ferrous Ingot Metal Institute, and we now have in process of formation the Lead Institute.

Why all these groups? It has been found by bitter experience that producers and manufacturers of metals and metal products, compete not only with their direct competitors in the same lines, but with manufacturers of other metals. Several years ago, copper made a tremendous drive to get back some of its consumers who had switched to other metals, and to find new fields. Aluminum has long been a roving attacker of other meals. Zinc has fought for years to find new fields, which, of course, means taking them away from other metals. Nickel has been one of the outstanding successes in finding new worlds to conquer. These industries were not particular whom they attacked so long as they added to their own territory. It is commonly known that tin is one of the outstanding targets of today in the United States, because of its high price in comparison with other metals, and the absence of this metal from our natural resources.

It did not take long for metal producers to wake up to the situation. Iron is another target and that industry has formed into groups, like the Sheet Steel Extension Committee, to protect itself. Stainless steel is offering an active resistance to the encroachment of corrosion-resisting non-ferrous alloys. Silver, crippled by steadily falling prices over a period of years, is organizing to find new markets; this is one purpose of the new Lead Institute; a wholly legitimate and commendable object.

Eventually, if that word can be used at all, the advantages of all of these metals will be made known by their proponents, in full detail. Naturally they will not state their own disadvantages, but these will be searched out and made clear by unbiased workers. Moreover, no sensible manufacturer will make claims for a metal which cannot be substantiated, as these claims will be rapidly destroyed by tests which the metal will have to undergo. The result will be a much better knowledge of what metals to use for various purposes.

It is doubtful, however, if this knowledge will ever be fixed and static. New alloys are constantly being developed, new and formerly rare metals are being made use of, and any standards must be subject to continual change. In the meantime, the war will go on, as the battle will go not only to the worthy but to the strong. A metal may be ever so useful, but its adoption will never be widespread unless its properties are made known. This can be done only by publicity, properly and carefully handled, backed by facts and adequate proof.

Aluminum in Automobiles

Ten years ago the use of aluminum in automobiles was growing by leaps and bounds. A few years later its growth was seriously hampered by its high price, in comparison with other materials, and it was common knowledge that the automobile manufacturers who were forced to cut their prices because of increasing competition, were eliminating, as far as possible, all expensive material. Aluminum, being classed as an expensive material, felt the pinch.

This condition seems to be changed however. According to R. S. Archer, in the August number of the Society of Automotive Engineers Journal, a definite trend seems to be under way toward the increased use of aluminum in passenger cars.

"For several years the chief motive in their manufacture seemed to be reduction of cost, and to attain this end some aluminum was replaced by iron or steel. The automotive industry has itself furnished, however, the great economic lesson that a point can be reached at which further reduction of cost does not produce increased sales.

"The present emphasis seems to be on performance. . . . An experimental aluminum car has demonstrated very clearly that aluminum construction offers possibilities of performance which are not attainable with steel."

The use of aluminum effects economies in fuel, tires and maintenance. Although the average car owner does not watch these items closely, commercial vehicles like coaches, taxicabs and trucks are watched very closely. Another item of importance is the fact that after a car has outlived its usefulness, the aluminum parts have a high salvage value, whereas iron or steel is practically worthless.

There seems to be a growing tendency in the public to add the demand for quality to its demand for a low price. During the war and immediately afterward, the price question was of little importance. The demand was for merchandise, the best if possible, but at any rate, merchandise. This was followed by the drastic deflation during which the price factor assumed a place of the highest importance. This condition still exists, but the demand for quality is beginning to raise its voice more and more insistently. The public no longer wants the cheapest; they ask for the cheapest and the best.

These two prerequisites are rarely compatible, but it seems likely that a broader view is spreading. The cheapest is not necessarily the item which costs least to begin with. It may be the article with the longest life. It is certainly the article with the lowest over-all cost and this includes such factors as length of life, upkeep cost, repairs, etc.

It would be beneficial in many ways if this view were generally accepted. There might be an end to the production of inferior goods and the terrific price-cutting which has been the bane of business and, in the long run, a detriment to the consumer.

Simplified Practice Is Growing

A report from the Division of Simplified Practice of the Department of Commerce, shows that during the quarter ending June 30, 1928, nine more simplified practice recommendations were reviewed. The average degree of adherence was about 84%.

According to Mr. Hudson who rendered this report the coming period should be marked by an increasing interest in, and application of the principles of simplified practice because of keen competition, the rising costs of doing business, shrinking profit margins and the importance of keeping inventories down to the lowest possible point. Manufacturers are awakening rapidly to the fact that large volumes of hidden profits lie in the extensive variety in the goods offered to the public. Decreases in the lines, items, sizes, types, styles, models and even brands result in better turn-over, smaller inventory investment, lower costs, quicker and better service and larger profits.

In these days of narrow margins and falling price structures every possible means must be used to eliminate waste effort and waste investment in order to cut costs. Manufacturers long ago learned that factory costs must be cut by the use of automatic equipment and labor saving devices. Now they are learning that sales costs can be cut by going directly to the consumer whenever possible, and fixed charges can be cut by holding inventories down to rock bottom.

For a time this may cause considerable discomfort, but it will result in a sounder structure throughout all business. It is one of the encouraging features of these tight times that inventories are kept down and that manufactures move very quickly from the plant to the consumer's hands.

The Forepart and Business Part of Herbert Hoover's Address of Acceptance

INDICATING HIS WIDE KNOWLEDGE OF THE NEEDS OF INDUSTRY, BUSINESS AND THE PEOPLE

You bring, Mr. Chairman, formal notice of my nomination by the Republican Party to the Presidency of the United States. I accept. It is a great honor to be chosen for leadership in that party which has so largely made the history of our country in these last 70 years.

Mr. Chairman, you and your associates have in four days traveled 3,000 miles across the continent to bring me this notice. I am reminded that in order to notify George Washington of his election, Charles Thompson, Secretary of the Congress, spent seven days on horseback to deliver that important intelligence 230 miles from New York to Mount Vernon.

In another way, too, this occasion illuminates the milestones of progress. By the magic of the radio this nomination was heard by millions of our fellow citizens, not seven days after its occurrence, nor one day, nor even one minute. They were to all intents and purposes, present in the hall, participants in the proceedings. Today these same millions have heard your voice and now are hearing mine. We stand in their unseen presence. It is fitting, however, that the forms of our national life, hallowed by generations of usage, should be jealously preserved, and for that reason you have come to me, as similar delegations have come to other candidates through the years.

Those invisible millions have already heard from Kansas City the reading of our party principles. They would wish to hear from me not a discourse upon the platform—in which I fully concur—but something of the spirit and ideals with which it is proposed to carry it into administration.

Our problems of the past seven years have been problems of reconstruction; our problems of the future are problems of construction. They are problems of progress. New and gigantic forces have come into our national life. The World War released ideas of government in conflict with our principles. We have grown to financial and physical power which compels us into a new setting among nations. Science has given us new tools and a thousand inventions. Through them have come to each of us wider relationships, more neighbors, more leisure, broader vision, higher ambitions, greater problems. To insure that these tools shall not be used to limit liberty has brought a vast array of questions in government.

The points of contact between the Government and the people are constantly multiplying. Every year wise governmental policies become more vital in ordinary life. As our problems grow so do our temptations grow to venture away from those principles upon which our republic was founded and upon which it has grown to greatness. Moreover we must direct economic progress in support of moral and spiritual progress.

Our party platform deals mainly with economic problems, but our nation is not an agglomeration of railroads, of ships, of factories, of dynamos, or statistics. It is a nation of homes, a nation of men, of women, of children. Every man has a right to ask of us whether the United States is a better place for him, his wife and his children to live in, because the Republican Party has conducted the government for nearly eight years. Every woman has a right to ask whether her life, her home, her man's job, her hopes, her happiness, will be better assured by the continuance of the Republican party in power. I propose to discuss the questions before me in that light.

With this occasion we inaugurate the campaign. It shall be an honest campaign; every penny will be publicly accounted for. It shall be a true campaign. We shall use words to convey our meaning, not to hide it.

The Republican Party came into authority nearly eight years ago. It is necessary to remind ourselves of the critical conditions of that time. We were confronted with an incompleted peace and involved in violent and dangerous disputes both at home and abroad. The Federal Government was spending at the rate of five and one-half billions per year; our national debt stood at the staggering total of twenty-four billions. The foreign debts were unsettled. The country was in a panic from over expansion due to the war and the continued inflation of credit and currency after the Armistice, followed by a precipitant nation-wide deflation which in half a year crashed the prices of commodities by nearly one-half. Agriculture was prostrated; land was unsaleable; commerce and industry were stagnated; our foreign trade ebbed away; five millions of unemployed walked the streets. Discontent and agitation against our democracy were rampant. Fear for the future haunted every heart.

No party ever accepted a more difficult task of reconstruction than did the Republican Party in 1921. The record of these seven and one-half years constitutes a period of rare courage in leadership and constructive action. Never has a political party been able to look back upon a similar period with more satisfaction. Never could it look forward with more confidence that its record would be approved by the electorate.

Peace has been made. The healing processes of good will have extinguished the fires of hate. Year by year in our relations with other nations we have advanced the ideals of law and of peace, in substitution for force. By rigorous economy federal expenses have been reduced by two billions per annum. The national debt has been reduced by six and a half billions. The foreign debts have been settled in large part and on terms which have regard for our debtors and for our taxpayers. Taxes have been reduced four successive times. These reductions have been made in the particular interest of the smaller taxpayers. For this purpose taxes upon articles of consumption and popular service have been removed. The income tax rolls today show a reduction of 80 per cent in the total revenue collected on income under $10,000 per year, while they show a reduction of only 25 per cent in revenues from incomes above that amount. Each successive reduction in taxes has brought a reduction in the cost of living to all our people.

Commerce and industry have revived. Although the agricultural, coal and textile industries still lag in their recovery and still require our solicitude and assistance, yet they have made substantial progress. While other countries engaged in the war are only now regaining their prewar level in foreign trade, our exports, even if we allow for the depreciated dollar, are 58 per cent greater than before the war. Constructive leadership and cooperation by the government have released and stimulated the energies of our people. Faith in the future has been restored. Confidence in our form of government has never been greater.

But it is not through the recitation of wise policies in government alone that we demonstrate our progress under Republican guidance. To me the test is the security, comfort and opportunity that has been brought to the average American family. During this less than eight years our population has increased by 8 per cent. Yet our national income has increased by over thirty billions of dollars per year or more than 45 per cent. Our production—and therefore our consumption—of goods has increased by over 25 per cent. It is easily demonstrated that these increases have been widely spread among our whole people. Home ownership has grown. While during this period the number of families has increased by about 2,300,000 we have built more than 3,500,000 new and better homes. In this short time we have equipped nearly nine million more homes with electricity, and through it drudgery has been lifted from the lives of women. The barriers of time and distance have been swept away and life made freer and larger by the installation of six million more telephones, seven million radio sets, and the service of an additional 14 million automobiles.

We have doubled the use of electrical power and with it we have taken sweat from the backs of men. The purchasing power of wages has steadily increased. The hours of labor have decreased. The 12-hour day has been abolished. Great progress has been made in stabilization of commerce and industry. The job of every man has thus been made more secure. Unemployment in the sense of distress is widely disappearing.

Most of all, I like to remember what this progress has meant to America's children. The portal of their opportunity has been ever widening. While our population has grown but 8 per cent we have increased by 11 per cent the number of children in our grade schools, by 66 per cent the number in our high schools, and by 75 per cent the number in our institutions of higher learning.

With all our spending we have doubled savings deposits in our banks and building and loan associations. We have nearly doubled our life insurance. Nor have our people been selfish. They have met with a full hand the most sacred obligation of man—charity.

One of the oldest and perhaps the noblest of human aspirations has been the abolition of poverty. By poverty I mean the grinding by under-nourishment, cold, and ignorance and fear of old age of those who have the will to work. We in America today are nearer to the final triumph over poverty than ever before in the history of any land. The poorhouse is vanishing from among us. We have not yet reached the goal but given a chance to go forward with the policies of the last eight years, and we shall soon with the help of God be in sight of the day when poverty will be banished from this nation. There is no guarantee against poverty equal to a job for every man. That is the primary purpose of the economic policies we advocate.

I especially rejoice in the effect of our increased national efficiency upon the improvement of the American home. That is the sanctuary of our loftiest ideals, the source of the spiritual energy of our people. The bettered home surroundings, the expanded schools and playgrounds, and the enlarged leisure which have come with our economic progress have brought to the average family a fuller life, a wider outlook, a stirred imagination, and a lift in aspirations.

Economic advancement is not an end in itself. Successful democracy rests wholly upon the moral and spiritual quality of its people. Our growth in spiritual achievements must keep pace with our growth in physical accomplishments. Material prosperity and moral progress must march together if we would make the United States that Commonwealth so grandly conceived by its founders. Our government, to match the expectations of our people, must have constant regard for those human values that give dignity and nobility to life. Generosity of impulse, cultivation of mind, willingness to sacrifice, spaciousness of spirit—those are the qualities whereby America, growing bigger and richer and more powerful, may become America great and noble. A people or government to which these values are not real, because they are not tangible, is in peril. Size, wealth, and power alone cannot fulfill the promise of America's opportunity.

Relations of Government and Business

With the growth and increasing complexity of our economic life the relations of government and business are multiplying daily. They are yearly more dependent upon each other. Where it is helpful and necessary, this relation should be encouraged. Beyond this it should not go. It is the duty of government to avoid regulation as long as equal opportunity to all citizens is not invaded and public rights violated. Government should not engage in business in competition with its citizens.

Business is practical, but it is founded upon faith—faith among our people in the integrity of business men, and faith that it will receive fair play from the government. It is the duty of government to maintain that faith. Our whole business system would break down in a day if there was not a high sense of moral responsibility in our business world. The whole practice and ethics of business has made great strides of improvement in the last quarter of a century, largely due to the effort of business and the profession themselves. One of the most helpful signs of recent years is the stronger growth of associations of workers, farmers, business men and professional men with a desire to cure their own abuses and a purpose to serve public interest. Many problems can be solved through co-operation between government and these self-governing associations to improve methods and practices. When business cures its own abuses it is true self-government which comprises more than political institutions.

One of the greatest difficulties of business with government is the multitude of unnecessary contacts with government bureaus, the uncertainty and inconsistency of government policies, and the duplication of governmental activities. A large part of this is due to the scattering of functions and the great confusion of responsibility in our federal organization. We have, for instance, 14 different bureaus or agencies engaged in public works and construction, located in nine different departments of the government. It brings about competition between government agencies, inadequacy of control, and a total lack of co-ordinated policies in public works. We have eight different bureaus and agencies charged with conservation of our natural resources, located in five different departments of the government.

Our Republican presidents have repeatedly recommended to Congress that it would not only greatly reduce expenses of business in their contacts with government but that a great reduction could be made in governmental expenditure and more consistent and continued national policies could be developed if we could secure the grouping of these agencies devoted to one major purpose under single responsibility and authority. I have had the good fortune to be able to carry out such reorganization in respect to the Department of Commerce. The results have amply justified its expansion to other departments and I should consider it an obligation to enlist the support of Congress to effect it.

The government can be of invaluable aid in the promotion of business. The ideal state of business is freedom from those fluctuations from boom to slump which bring on one hand the periods of unemployment and bankruptcy and on the other, speculation and waste. Both are destructive to progress and fraught with great hardship to every home. By economy in expenditures, wise taxation, and sound fiscal finance it can relieve the burdens upon sound business and promote financial stability. By sound tariff policies it can protect our workmen, our farmers, and our manufacturers from lower standards of living abroad. By scientific research it can promote invention and improvement in methods. By economic research and statistical service it can promote the elimination of waste and contribute to stability in production and distribution. By promotion of foreign trade it can expand the markets for our manufacturers and farmers and thereby contribute greatly to stability and employment.

Our people know that the production and distribution of goods on a large scale is not wrong. Many of the most important comforts of our people are only possible by mass production and distribution. Both small and big business have their full place. The test of business is not its size—the test is whether there is honest competition, whether there is freedom from domination, whether there is integrity and usefulness of purpose. As Secretary of Commerce I have been greatly impressed by the fact that the foundation of American business is the independent business man. Alike with our farmers his is the stronghold of American individuality. It is here that our local communities receive their leadership. It is here that we refresh our leadership for larger enterprise. We must maintain his opportunity and his individual service. He and the public must be protected from any domination or from predatory business.

Thomas A. Edison, the inventor and manufacturer, says:

"If the people of our great commercial nation fail to obtain Hoover to manage their business for them they will show a pretty low state of intelligence."

THE METAL INDUSTRY believes that if they fail to elect Hoover it will be a national loss and misfortune.

Correspondence and Discussion

Silica and Magnesite Bricks

To the Editor of THE METAL INDUSTRY:

Referring to the article "Silica and Magnesite Bricks," by Gerhard Wolff, appearing in THE METAL INDUSTRY for December, 1927, the order of silica transformation is given as Quartz-Christobalite-Tridymite. This is in agreement with Le Chatelier's statement, Trans. Am. Institute of Mining and Metallurgical Engineers, Vol. LX, page 139, where density of Christobalite is given as 2.34 and Tridymite as 2.27. Mineralogists (see Dana, etc.) reverse this order to Quartz-Tridymite-Christobalite, and state density of Tridymite to be 2.34, and Christobalite, 2.27. Who is right?

Vancouver, Canada,
May 24, 1928.

H. N. THOMSON,
Univ. of British Columbia.

To the Editor of THE METAL INDUSTRY:

There can be no doubt that the true theoretical order of silica transformation is Quartz-Tridymite-Christobalite, as given by Dana and the majority of modern metallurgists and ceramists. It has become a matter of general practical knowledge that at a temperature of 1,000° C. (about 1,820° Fahr.) quartz is transformed into Tridymite, while at a temperature of 1,470° C. (about 2,675° Fahr.) transformation proceeds over the Tridymite phase to Christobalite, the final transformation of this crystalline phase of silica into amorphous quartz glass taking place at above 1,685° C. (3,065° Fahr.).

However, both Cristobalite and Quartz glass are unstable, and on prolonged heating at temperatures of from 1,200-1,400° C. (2,200-2,550° Fahr.) these phases are gradually converted into the stable Tridymite, so that the practical, final, result of a complete heating treatment of silica materials will be the conversion of all the free, uncombined, silica of the refractory material into Tridymite, at a theoretical increase of volume of 14.2 per cent.

The question concerning the specific gravities of the individual phases of silica is not as easily answered. It appears that the true specific gravities are 2.65, 2.28 and 2.33 for Quartz, Tridymite, Christobalite, respectively. Other authorities of renown reverse the order of specific gravities of Tridymite and Christobalite.

It is difficult for the metallurgically trained mind to point out the reason for this striking disparity of figures, but it appears that this is chiefly due to different experimental conditions, especially regarding the temperatures at which the specific gravities of the various phases and modifications of silica have been determined.

In my article on "Silica and Magnesite Bricks in Metallurgical Furnaces" I pointed out that, apart from the definite expansion of silica bricks caused by the transformation of Quartz into the stable Tridymite phase, the alpha-modification of these phases are converted into the respective beta-modifications whenever heated beyond a certain critical temperature typical of this particular phase, returning to their original state if the temperatures drop below the respective critical temperatures (1,070° Fahr, for Quartz, and about 400° Fahr. for Tridymite). These transformations within the individual phases are also accompanied by expansion, the degree of expansion being most considerable in the case of Quartz and smallest with Christobalite.

Now, since practically all the publications on this subject assigning a specific gravity of 2.28 and 2.33 for Christobalite and Tridymite, respectively, use the terms "b-Tridymite" and "b-Christobalite," while the others, reversing this order, speak of Tridymite and Christobalite without mentioning the particular modifications, it appears that the misunderstanding in question is in part due to a lack of common agreement concerning the particular crystaliine modifications of the phases of silica subjected to the research work of different authorities, especially since the critical points of transformation in both instances differ by more than 150° Fahr.

Conditions are considerably more complicated considered from a practical point of view. The general influence of natural and artificial impurities of silica bricks on their physical and mechanical properties are generally understood, of course, but the extent to which the specific gravity of the three—or four—phases of silica may be changed by constituents, such as lime, alumina, and iron oxide, are usually underestimated by metallurgists. There can be no doubt, in fact, that the determination of the specific weight, which is generally used as indicator of the degree of transformation of silica bricks, and the subsequent degree of expansion after building-in, is absolutely inadequate, since the rates of change of specific gravities caused by identical amounts of impurities, and their relation to the true specific weights, is by no means identical in the various phases and modifications of refractory silica bricks.

For instance, the lime contents of thoroughly burned silica material, which are present as calcium silicate, have been determined as Pseudo-Wollastonite, the alpha-modification of calcium-metasilicate ($CaO.SiO_2$) which is also believed to be subject to crystallographical changes at rising temperatures. The specific gravity of Wollastonite is 2.8 to 2.9. If it is considered that at a percentage of, say, 4 per cent of lime in the silica material the amount of Wollastonite present exceeds 8 per cent—and that similar conditions prevail in the case of practically all the other constituents of silica bricks—the degree of influence exerted by the impurities is readily understood.

Philadelphia, Pa.,
July 8, 1928.

EDMUND R. THEWS.
(Gerhard Wolff)

New Books

Standards Yearbook, 1928. Compiled by the National Bureau of Standards, as Bureau of Standards Miscellaneous Publication No. 83. Obtainable from Government Printing Office, Washington, D. C. Size, 6 x 9; 399 pages; price, $1.00.

A complete outline standardization work throughout the United States, including the activities of states, counties and municipalities as well as of the various federal bureaus and agencies, which includes the United States Bureau of Standards. A resume is given of standardization work by scientific and technical societies and trade associations. Foreign activity in standardization is covered also. Extensive bibliographical material on standardization is contained and to those interested in standardization of any sort, this work must be indispensable. A considerable amount of the material pertains to non-ferrous metals and allied subjects.

Storage Batteries. By Morton Arendt. Published by D. Van Nostrand Company, Inc., New York. Size, 6 x 9; 285 pages; price, $4.50.

During the past five years the sale of storage batteries have mounted to the stupendous figure of $100,000,000 per year, from a former figure of around $12,000,000. The increase in use of storage batteries has been caused in large part by the radio, as well as the growing use of electric and gasolene motor vehicles. A large technical industry has thus grown up, and data on the manufacture of this important commodity is needed. Prof. Arendt has here set down the history of the industry; the general theory upon which the storage battery operates; a description of the production of lead battery plates; and discussions of such kindred subjects as the sulphuric acid electrolyte; factors influencing capacity and efficiency. He also devotes space to installation and operation of storage batteries; the nickel-iron alkaline cell; testing of batteries; applications of the storage battery. The book is practical and should prove valuable to battery users and makers.

Nema Handbook of Apparatus Standards. Published by the National Electrical Manufacturers Association, New York. 17th edition, 1928; 348 pages. Price, $3.00.

This book embraces standards of electric power, control and measuring apparatus for the generation, distribution and utilization of electric energy. Each section of the Handbook, covering such apparatus as motors and generators, industrial control, transformers, switchgear, measuring instruments, electric welding, etc., is complete in itself, all the rules relating to each product being grouped together. Standard definitions, abbreviations and symbols are also included for each class of apparatus.

Shop Problems

This Department Will Answer Questions Relating to Shop Practice.

ASSOCIATE EDITORS { JESSE L. JONES, Metallurgical / WILLIAM J. PETTIS, Rolling Mill   W. J. REARDON, Foundry / P. W. BLAIR, Mechanical   CHARLES H. PROCTOR, Plating Chemist

Black on Brass or Steel

Q.—We are interested in obtaining a black finish on small metal parts. The stock is brass and steel. The brass or steel can either be copper or nickel plated in order to obtain the final black finish. Can you advise us on this subject? What books do you recommend?

A.—We suggest that you first copper plate the articles as copper is more readily oxidized to a black finish that any other metal. After copper plating, wash thoroughly and immerse for a few minutes in either of the two solutions below, then remove as soon as the copper turns black. Wash thoroughly, then dry out in warm sawdust.

SOLUTIONS FOR OXIDIZING COPPER

No. 1	Water, at 160°F.	1 gallon
	Polysulphide of soda	¼ to ½ oz.
	Aqua ammonia, 26°	⅛ oz.
No. 2	Water	1 gallon
	Hyposulphite of soda	4 ozs.
	Lead acetate	4 ozs.
	Polysulphide of soda	⅛ oz.
	Temperature, 180°F.	

A thorough, practical work covering the coloring of metals is Hiorn's "Coloring of Metals," which can be secured from THE METAL INDUSTRY. PLATERS' WRINKLES also gives a good deal of practical data covering coloring of metals.—C. H. P., Problem 3,777.

Cadmium on Nickel

Q.—What effect has cadmium on nickel deposit? Will such a plate stand up as well as one not using same? I would like to try this method of bright plating in a mechanical tank, but not until you advise of the effects to plate. These questions have occurred to me since reading in "Platers' Wrinkles" that cadmium sticks can be used for bright nickel plating.

A.—Cadmium is used very extensively as a brightening agent for nickel plated articles irrespective of what the basic metal is. The metal is colloidal in its action, just as arsenic is in a brass solution, hyposulphite of soda in a copper solution, or carbon disulphide in a silver solution. All these colloidal factors produce a finer crystalline structure, resulting in bright deposits of metal. Such deposits are considerably harder, so an excess of any brightening agent must be avoided; especially is this true of cadmium in nickel solutions. It is our opinion that when nickel deposits containing minute amounts of cadmium are plated upon steel, the result is a better rust-resisting deposit. Cadmium is best added to a nickel solution in the form of cadmium chloride. The sticks should be cut down in a mixture of equal parts of muriatic acid and water. Add cadmium sticks until the acid mixture will dissolve no more. You will then have a concentrated solution of cadmium chloride. One-half ounce of the cadmium chloride, liquid measure, should be added to each hundred gallons of nickel solution. It is best to add this solution at the close of the day's work, stirring it thoroughly into the bath. Repeat the solution if the nickel deposit is not bright enough, but make the addition only at intervals of several hours. When you become familiar with the use of cadmium, you can use one or two sticks for each mechanical barrel, to keep them constant in solution. Place them on the anode rods as anodes. Always remove them when the solutions are not in operation. You will get dark streaks in your nickel deposits if an excess of cadmium is allowed to accumulate in the solution.

—C. H. P., Problem 3,778.

English Hope Finish

Q.—Kindly advise us of a method for getting "English Hope" finish. This is an iridescent, light statuary, bronze effect.

A.—This finish is produced upon brass, usually on plain surfaces. The brass should be cut down to a smooth surface with Tripoli composition. If the articles are made of cast brass, the usual emery wheel polishing must be carried out before cutting down with regular buffs and Tripoli composition.

Cleanse the articles as for plating, then immerse them in a solution as follows: aqua ammonia 26°, 1 gallon; red antimony sulphide, 8 to 16 ounces; mix this thoroughly and heat to 160° F., by surrounding the stoneware container with water hot enough to give 160° F. minimum. Immerse the brass articles in the solution for a minute or two, keeping them in constant motion, then remove them, drain well, then let them hang in the air of the plating room for a minute or two. Wash them in cold and boiling hot waters. Next, dry the articles, and scratchbrush dry with a very soft brass wire scratch brush. Finally, lacquer the surface for protection. Some firms operate two solutions to obtain this finish. The first solution consists of water, 1 gallon; copper sulphate, 1 ounce; potassium chlorate, 1½ ounces. The solution is heated to 180° F. The brass articles, prepared as outlined, are first immersed in this solution for a moment or two. They will turn an olive green tone; then remove them; wash in cold water; immerse in a solution of ammonia and red sulphide of antimony, as first mentioned. By operating the two solutions more rapid results are obtained.—C. H. P., Problem 3,779.

Plating Reflectors

Q.—Please advise the thinnest coating of nickel which will cover brass. My interest is in the reflecting surfaces of auto head lamps. Some of my associates were in a lamp factory where they saw reflectors being plated with nickel and then flashed with silver after which they were color buffed. The reflectors came to the plater highly polished, were nickel plated for a few minutes, rinsed, and then flashed with silver for two or three seconds. After plating the reflectors were color buffed. I understand that the thinner the plating, the less finishing will be required. Is this correct?

A.—In plating auto lamp reflectors made of brass, the surface must be polished to a high lustre. After polishing, the reflectors must be cleansed with mild alkaline cleaners to avoid excessive tarnishing and dulling of the polished surface. After washing in water they should be plated in any first class nickel solution which plates white and bright and has good throwing power.

The time of nickel plating should be about three minutes. They must not be burnt by excessive current. After nickel plating, the reflectors are thoroughly washed in water and silver plated for not more than one minute maximum; quite frequently it is done for only a few seconds. The silver solution approximates the following proportions.

Water	1 gallon
Sodium cyanide 96-98%	9 ozs.
Silver cyanide	1 oz.
Caustic potash	½ oz.
Sal-ammoniac	⅓ oz.

Anodes, sheet steel to which small silver anodes are attached.

The reflectors are finally color buffed with very soft buff wheels, with dry lamp black mixed to a paste with equal parts of kerosene and denatured alcohol. Very little of the polishing medium is necessary for a lustre silver finish.—C. H. P., Problem 3,780.

Producing Wood Grain on Copper

Q.—Please give me information on graining with sheets of copper and rollers. Where can I purchase the necessary materials and equipment?

A.—We do not know exactly what kind of graining you want to do. In any first class paint store you can purchase rubber rollers with grain marks in high relief. The copper must first be coated with the desired priming coat of enamel or flat color paint. Then the graining ground is applied to the rubber roller with pads which are made like the ink pads used for rubber stamps. The rubber roller leaves the imprint of the grain upon the enameled copper and when dry, or partly dry, it is toned down with camel's hair brushes. Copper sheet can be purchased from any of the metal concerns. (See advertising section of THE METAL INDUSTRY).

Possibly you have reference to graining by the etching process. This is entirely different from the above and requires a different treatment of the copper. It would mean a photo-etched copper plate, similar to an electrotype, with the desired grain of wood etched in the copper and in high relief. The copper plate is inked and the grain design is transferred to the copper plate to be grained with a heavy black printer's ink which is used for this purpose. When the ink is dry and hard, the copper plate is etched in a perchloride of iron solution,—2 lbs. per gallon of water, with 2 ozs. of bichromate of soda. After the etching has been done, the plates should be thoroughly washed and oxidized, then relieved to show up the grain of the wood that is being reproduced. We do not know where you can purchase the etched copper plates, but this might be found out by reference to firms under the headings of "photo-etchers" and "engravers" in a classified directory.—C. H. P., Problem 3,781.

Removing Nickel and Paint

Q.—I would greatly appreciate your telling me the best way to take the nickel off old nickel plated plumbing fixtures. I would also like to know how to take the paint off automobile parts such as radiator shells, head lamps, etc.

A.—For your purpose an acid strip based upon the following proportions will give the best results in stripping nickel from plumbers' brass fixtures:

Sulphuric acid 60°	3 gallons
Nitric acid 38°	1 gallon
Water	1 pint

Mix the acid dip in the order given and use when cold. Nickel can be stripped from brass in a very few minutes. Be careful not to add too much water; an excess produces a matted or rough brass surface after the nickel has been removed.

To remove enamels from automobile parts, there is nothing better than a strong hot solution of caustic potash:

Water	1 gallon
Caustic potash	8 to 12 ozs.

Temperature 180 to 212° F.

It takes some little time to remove the paint or enamel, but there is nothing better than caustic potash for the purpose.—C. H. P., Problem 3,782.

Solution for Heavy Gold Plate

Q.—Can you tell us the formula for an acid gold plating solution? We find it difficult to produce the heavy gold deposit we require with a cyanide solution.

A.—Gold cannot be plated with acid solution. If you desire a heavy deposit of gold it is advisable to operate a normal temperature solution at about 80°F. The following solution will produce a heavy gold deposit:

Water	1 gallon
Sodium cyanide	3 ozs.
Sodium gold cyanide	1 oz.
Sodium bisulphite	¾ oz.
Caustic potash	¼ oz.
Hyposulphite of soda	1/16 oz.

Voltage, 2½ to 3½; anodes, fine gold; some narrow strips of pure rolled sheet nickel can be used as anodes together with the gold anodes. This aids the operation.

Prepare the solution as follows:—In one pint of water at 140°F. dissolve the sodium and gold cyanide, then mix with the remaining water cold to make up one gallon. Add the bisulphite of soda, caustic potash and hyposulphite of soda in the order given. The solution is then ready for use.—C. H. P., Problem 3,783.

Stained Brass Finish

Q.—We are inclosing a sample finish which we term stained brass, with the idea in mind that you will be able to help us as to the best method of getting this finish. We are desirous of using this finish on production basis and would like to know the best method to use to turn out this material both swiftly and economically.

A.—The sample brass shell submitted to us for finish is known in the electric fixture trade as "Old English" or "Spanish Burnt Brass." There are several methods of producing this finish. Quite frequently the bronze tone is much darker. The brass is shown just a little. This is accomplished by rubbing the surface with dry pumice stone or with a small, slow running, soft buff wheel, with a pumice and stearic acid composition. This finish can be brought down to a production basis, but this will depend upon the size of the solution you install in volume capacity. The procedure is as follows:

The brass shells should be cut down with tripoli to a smooth finish, then cleaned under usual conditions with regular alkaline cleaners. Basis solution:

Water	1 gallon
Copper sulphate	3 ozs.
Sodium chlorate	3 ozs.

Temperature of solution, 180 to 200° F.

Use this bronzing solution:

Aqua ammonia, 26°	1 gallon
Red sulphide of antimony	8 to 16 ozs.

Temperature, 160° F.

The solutions should be placed in stoneware jars which are placed in wooden or steel tanks heated with steam coils to maintain the water surrounding the jars at 160-180° F. The brass shells, etc., should first be immersed in the basis solution for a moment or two until they change to an olive green tone. Remove them, wash in water, and immerse in bronzing solution until a dark reddish bronze results. Remove them; wash in boiling hot water which is kept especially for this purpose, so that only enough water should be added to maintain the original water line. Remove from the first hot water and rinse in cold water and then again in clean hot water; then dry out in hardwood sawdust. Finally, scratchbrush very lightly with a very soft brass wire scratch brush; lacquer the shells by spraying to protect the finish. Instead of using the bronzing solution, you may try out either of the following solutions under identical conditions:

Water	1 gallon
Polysulphide	¾ oz.
Caustic potash	½ oz.

Temperature, 180° F.

Water	1 gallon
Barium sulphide	2 ozs.
Caustic potash	1 oz.

Temperature, 180° F.

These solutions will produce a dark brown upon brass in connection with number 2 basic solution.

—C. H. P., Problem 3,784.

Silvering and Gilding

Q.—How can we silver or gild small brass articles without plating?

A.—See Platers' Wrinkles, page 17, for dip gilding solutions. For silvering, use the following solution:

Water	1 gallon
Sodium cyanide, 90-98%	2 ozs.
Silver cyanide	¾ oz.
Caustic potash	3 ozs.

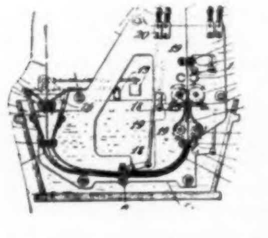
Prepare this by using one-third of the water first, at 160° F., to dissolve the sodium cyanide and silver cyanide, then add the balance of the water and then the caustic potash. The solution is used at 80° F., and higher temperatures as desired.

—C. H. P., Problem 3,785.

Patents

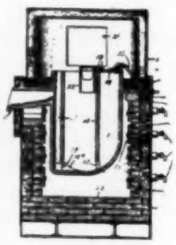
A REVIEW OF CURRENT PATENTS OF INTEREST

1,672,526. June 5, 1928. **Metal-Coating Machine.** Wilford J. Hawkins, Montclair, N. J., assignor to American Machine and Foundry Company, a Corporation of New Jersey.



The combination with means for supporting a bath of molten coating metal, of means whereby material to be coated is caused to pass through and emerge from said bath, means for circulating clean molten metal from said bath above its surface adjacent the point of emergence, and means acting on the circulating metal to uniformly compact a part of it on and to dress all in excess thereof from the material before it reaches the air.

1,672,728. June 5, 1928. **Metal Pot.** Albert N. Otis, Schenectady, N. Y., assignor to General Electric Company, a Corporation of New York.



A molten metal pot comprising a receptacle, a partition in said receptacle driving said receptacle into a plurality of chambers communicating with each other, said receptacle being provided with an outlet duct extending downward into one of said chambers, and means for forcing the molten metal out of the other of said chambers, into the first whereby said metal is caused to flow out through said duct.

1,674,232. June 19, 1928. **Composition for Permanent Molds for Metal Casting.** Harry Todd, Linthorpe, Middlesborough, England.

A composition for permanent molds comprising a mixture of sillimanite and monazite sand in the proportions of 45 per cent and 25 per cent, respectively, and a binder of cow hair, plaster of Paris, china clay and ganister.

1,674,438. June 19, 1928. **Process of Producing Nickel Alloys.** Noak Victor Hybinette, Wilmington, Del.

The method of producing nickel alloys which comprises subjecting a nickel-containing bath to an oxidizing treatment, deoxidizing the oxidized bath with deoxidizer forming a non-gaseous oxide, and adding an alloying metal or metals to the deoxidized bath.

1,674,694. June 26, 1928. **Protective Composition for Metal-Coating Baths.** Edwin R. Millring, New York, N. Y., assignor to American Machine & Foundry Company, a Corporation of New Jersey.

A composition of matter for protecting the surface of molten metal coating baths against oxidation, which consists of a mixture of rape seed oil and a petroleum product possessing a fire point in excess of 350° C.

1,675,008. June 26, 1928. **Process for the Manufacture of Copper Alloys.** Oscar von Rosthorn, Miesenbach, near Neustadt, Austria.

A process of making copper alloys containing low fusing components and a high percentage of copper, by the use of intermediate alloys, which comprises adding the intermediate alloys in two parts to the molten copper, the first part added containing the lowest fusible component and the second part added containing higher fusible components.

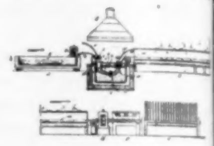
1,675,134. June 26, 1928. **Metal-Coated Sheet and Method of Making the Same.** Henry A. Roemer, Canton, and David A. Williams, Louisville, Ohio.

The method of coating and treating iron or steel sheets, which consists in coating such sheets with spelter and then subjecting the coated sheets to a cold rolling in order to produce a coating which will withstand severe forming or be subjected to high temperatures without scaling or peeling and which may be spot welded or have enamel or paint applied directly thereon.

1,675,264. June 26, 1928. **Treatment of Nickel-Copper-Aluminum Alloys.** Truman S. Fuller, Schenectady, N. Y., assignor to General Electric Company, a Corporation of New York.

The process of improving the physical properties of an alloy consisting largely of nickel and copper and a relatively small amount of aluminum which consists in deforming said alloy at a temperature of about 1000° C. and thereafter finishing the deformation at a temperature materially lower than 1000° C. but above 500° C.

1,675,646. July 3, 1928. **Method of Zinc Coating Ferrous Metal.** Joseph G. Fitz Gerald, Canton, Ohio, assignor, by direct and mesne assignments, to Central Alloy Steel Corporation, Canton, Ohio.



The method of zinc coating ferrous metal, which consists in heating the metal to be coated to from 850° to 950° F. and then coating it in a molten spelter bath to produce a tight coat.

The method of zinc coating a ferrous metal, which consists in coating the metal in a molten spelter bath, and then controlling the temperature of the cooling of the hot coated metal to produce the desired character and appearance of the coating.

1,675,664. July 3, 1928. **Welding Medium for Aluminum.** Wilhelm Reuss, Mannheim, Germany.

A soldering or welding medium consisting of a mixture of equal parts of borax, boracic acid and caustic potash.

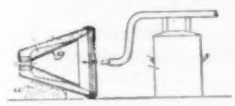
1,675,708. July 3, 1928. **Alloy.** Noak Victor Hybinette, Wilmington, Del.

An alloy of aluminum with metals of the iron group in which the aluminum forms upwards of about 90 per cent of the alloy, said alloy containing nickel and iron in small but substantial amount, and said alloy containing at least one of the following metals, namely, chromium, tungsten and molybdenum, in substantial amount less than 1 per cent, said alloy being practically free from copper.

1,675,709. July 3, 1928. **Heat-Resisting Alloy and Structure.** Noak Victor Hybinette, Wilmington, Del.

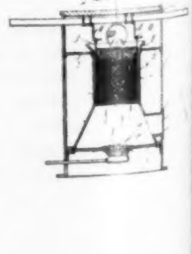
An alloy which is heat resisting at high temperatures containing the following ingredients in approximately the following proportions: nickel from about 5 to about 10 per cent, chromium from about 15 to about 25 per cent, carbon from about 1 to about 2 per cent, aluminum from about ½ to about 2 per cent, the remainder mainly iron.

1,675,735. July 3, 1928. **Method of Baking the Linings of Crucibles.** Franz Stöhr, Essen/Ruhr, Germany.



The method of baking the refractory linings of crucibles provided with an open top at one end and a tap opening at the other end, which comprises applying a closure to the open top of the crucible, projecting a combustible fluid jet through said opening, and venting the products of combustion through the tap opening.

1,675,926. July 3, 1928. **Method of Treating Articles Being Galvanized.** Theodore A. Dissel, Winchester, Mass., assignor to Cameron Appliance Company, Everett, Mass.



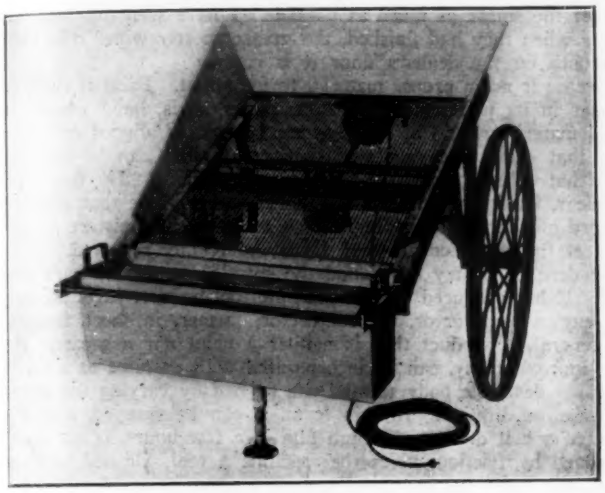
Those steps in the process of galvanizing articles which comprise vaporizing a flux, and passing the vapor through a mass of the hot zinc coated articles.

Equipment

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST

Mobile Foundry Screen

The Deister Concentrator Company, Fort Wayne, Ind., manufactures a mobile electric foundry screen which, while having



NEW TYPE FOUNDRY SCREEN

the features of the company's "Leahy No-Blind" vibrating screen for permanent setting, can be moved from place to place, according to required location. The maker states that the screen has a free swinging jacket, differential vibration which provides for stratification, unblinding and screening, providing a highly efficient method of screening either wet or dry material through openings ranging from 3 in. down to 60 mesh. It is claimed that the action of the machine results in perfect stratification of foundry sand, resulting in perfect blending, fluffing and aerating, with breakage of sand lumps and removal of shot iron, gaggers, core parts and other foreign matter. The advantages claimed are:

The Leahy screen is easily portable and very rugged. The vibrator is Timken equipped and self-oiling. It is operated by direct application of ½ h. p. motor, 110 volts, and is equipped with 50 ft. of special electric cord so that it may be plugged in at any convenient light socket or outlet to operate over a large area of floor.

The screen cloth alone vibrates; there is no movement of the frame caused by the vibrating mechanism. Therefore the wheels are stationary; they cannot move with the vibration of the screen as is the case of screens using such means as an unbalanced pulley for vibration.

Overall dimensions are 5 ft. 8 in. wide by 6 ft. long by 4 ft. 10 in. high. Actual screening surface is 3 ft. by 4 ft. The screen will run over a sand heap 4 ft. wide by 3 ft. high. Pitch is adjustable from 20° to 30°. Actual daily operation in a local foundry has demonstrated that this screen has considerably greater capacity than two men can handle. On the other hand, it is so easily mobile that it can be used on a one man operation. The tailing box is easily removable, and is equipped with screen bottom so that it effects a further cleaning and better recovery of sand.

Angle Cutting Hacksaw

The J-B Engineering Sales Company, New Haven, Conn., manufacturers of power house equipment, gears and material handling devices, has placed on the market a mechanical hacksaw, known as the "Mansaver," which it claims has a number of desirable features such as the ability to cut sawing expenses in any plant using a hand hacksaw even as little as two hours per day, lightness, and ease of operation.

The device is capable of cutting 50 degrees either left or right and any intermediate angle, the company states. It can be operated from a lamp socket and is portable. The motor and saw are mounted on a single cast iron base. The saw operates through a 6-inch stroke at 150 strokes per minute and the depth of the saw is 5¼ inches. A cut 10 inches long can be made by reversing the saw and special saws can be supplied for deeper cuts. Power is supplied through six feet of rubber-covered cord with plug attached. There is a switch on the operator's handle for starting and stopping, and this, it is claimed, is under the operator's full control at all times, permitting very delicate control. The angle can be changed while the saw is in motion and the construction is so arranged that the entire saw and motor can be moved 12 inches horizontally with the saw in motion.

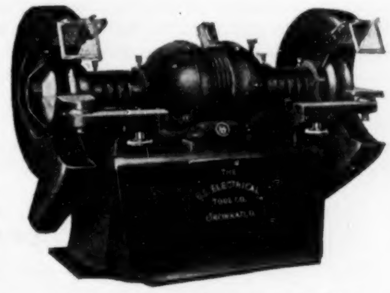
Chromium Plated on Aluminum

The Atlas Plating Works, Inc., 277 East 156th Street, Cleveland, Ohio, announces that it has succeeded in applying chromium plate to aluminum articles, especially wearing parts and instruments. This company, using the "Crodon" process, states it has one of the largest and most complete plating plants in the midwest, excepting Chicago. It does nickel and copper plating as well as chromium, operating on high grade automobile parts on a heavy production basis. It is stated that the chromium plate applied to aluminum has been made to adhere as well as chromium adheres to steel and copper.

New High-Speed Grinder

A new machine especially designed and built for high speed grinding and snagging is being introduced by its makers, The United States Electrical Tool Company, Cincinnati, Ohio, builders of electric drills and grinders.

A speed of 9,500 surface feet per minute is obtained on this machine with wheels 30 inches in diameter, having 2½ or 3-inch face, 18-inch hole, and operating on 40 or 60 cycles. When worn down to 24-inch diameter, the wheel turns at 7,500 s. f. p. m.—or an average of 8,500. On 25 and 50 cycle circuits, 24-inch wheels with 2½ or 3-inch base and 12-inch hole are recommended, giving 9,300 s. f. p. m. This machine is furnished for 220, 440, 550 volts 2 or 3 phase alternating current, and 220 volts direct current.



NEW HIGH-SPEED GRINDER

The motor is 15 horse power, designed for heavy duty grinding service, and built to A. I. E. E. specifications. It is rated for continuous service at full horse power with a temperature rise of 40 degrees, and with a momentary overload capacity of more than 100 per cent.

This "U. S. Hispeed Snagger" is built to American Engineering Standard code of safety. The wheel flanges are keyed to the shaft and securely clamped to the wheel by cap screws. Structural steel safety hoods over the wheels are built for wheel speeds of 10,000 s. f. p. m., and the doors on the safety hoods are also fastened on by cap screws.

The shaft is made of nickel steel in one piece and mounted on four heavy duty ball bearings in dust-proof housings. High quality materials and rugged construction are used.

Fighting Demon Rust

By C. G. BUCHANAN

President, Buchanan Chemical Company, Cincinnati, O.

There are some things in modern practice that might well be prefixed, "as prehistoric man did, so do we today." Science has made wonderful strides in the last decade, but almost entirely in the field of motion—lost motion, fast motion, continuous and high speeds, non-stop flights, ad infinitum. But what of those changes that progress so slowly that they are almost imperceptible? Rust and decay are progressing slowly and surely against both man and materials. I will not dwell upon those places where rust has been attacked successfully. "Save the surface and you save all" is a well chosen slogan, only see that decay does not have an opportunity to continue its progress beneath the surface.

If the skeptic cares to be convinced of the ravages of rust, one visit to a junk yard should be enough. Piles of metal from every conceivable place and every possible application. They have been touched by tongues of flame, the unnoticed, heatless flame, the uniting of air and water in the gradual return of the steel and iron to the condition whence it came. A force that requires man's constant vigilance, a continual fight, a never ceasing combat.

Verily, the old saying is more than correct: "more machinery rusts out than is worn out." Whoever heard of painting ball or roller bearings, shafts, gears or the thousand and one parts that make up the demands of our automotive industry or parts manufacture? Or whoever heard of a machine tool maker painting hand wheels, dials, knobs, guides, etc.? The answer comes clear and distinct: all of these parts are greased to prevent rusting.

The machine tool builder spends thought, time, money and labor producing the best machine he can possibly make. He uses modern production methods, the best of materials, alloy steels, properly heat treated, expensive conveying and lifting machinery, in short, any and all modernity to produce a first-class product. The machine arrives on the shipping floor and then he reverts to his ancestors' practices and to keep it from rusting he smears five or ten pounds of mussy grease on it and calls it a day. I have seen many a machine, an engine or compressor, loaded aboard car. The men are bound to grab hold of the product for moving, for crating or for skidding and they usually wear gloves to keep themselves out of the smear as much as possible. I have seen this same machine when they had finished, the grease mostly wiped off. After a month on the dealer's floor it is rusty.

Grease is not a proper material to fight rust. Paint is right and proper in its place, but for racks, shafts, dials, hand wheels, the ideal material would be one that can be painted, dipped or sprayed on; that can be so regulated that a thin film can be deposited. One that will not mess and smear up the machine. The film should be clear, hard, dry out in a few hours to a surface that cannot be rubbed off, be absolutely impervious to water or moisture so as to protect the steel beneath and, lastly, be readily removed.

Modern chemistry has found the solution to this difficult problem. It has produced for the machine tool builder, parts producer, the engine constructor, the contractor, farmer, in short, humanity in general, a product that is neither a paint nor a grease. It is soft in consistency, can be incorporated with gasoline as a solvent and any desirable body wanted can be had by varying the amount of gasoline dilution. In this form, it can be sprayed, dipped or painted on; it dries to a tough film in a few hours, is not readily removed by friction, gives the machine a real, finished look, one that will make the customer comment upon its good appearance. It is readily removed by rubbing over the protected surfaces with a gasoline soaked rag. If you are expecting it to be as cheap as grease, don't investigate it; grease is cheap, literally and figuratively. But in comparative cost, there is not much difference, as very little is required for a good job.

Chromium Plated Sheets

A line of chromium plated sheets and strips, ready for fabrication into chromium plated products without necessity of further plating, has been placed on the market by The American Nickeloid Company, Peru, Ill., under the trade name of "Chromaloid." For this product the company claims all the well known advantages of chromium plate, with the further advantage that such producers as do not wish to do their own plating on articles made of sheet or strip can now use this material for fabrication. The company states that "Chromaloid" has a platinum-like finish of great beauty and permanence. The company operates plants at Peru, Ill., and Walnutport, Pa.; the general offices are at Peru. Full information on the new product can be obtained by application to the manufacturers.

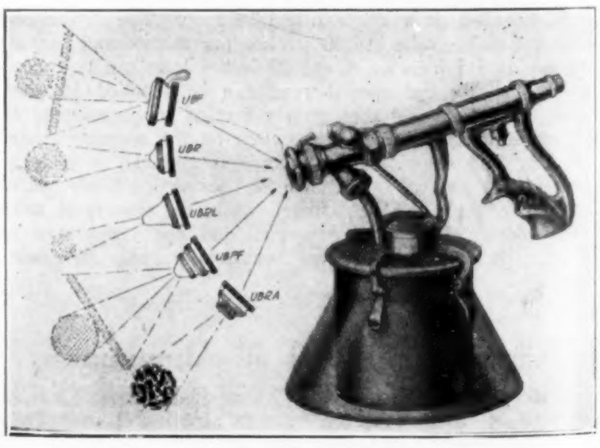
Refractory Spray Gun

A new type of refractory spray gun suitable for maintenance of furnace linings, boiler settings and other repair and construction work with refractories, has been placed on the market by the S. Obermayer Company, Chicago, Ill. The new device known as the "Esso Refractor Gun," it is claimed, is capable of building up a refractory wall from one-half to one and one-half inches thick. Other features claimed for it are that it mixes mechanically its own cement, operates on an air pressure as low as 30 pounds, prevents waste of refractory cement, can be handled by one man and sprays 20 gallons of cement on one filling.

The description given states that each apparatus is equipped with a 20-gallon tank having an adjustable reducing valve for regulating the air pressure to be used. There are two interchangeable nozzles, one long and one short, for places easy to reach and hard to reach, respectively, and two 25-foot lengths of hose for carrying air and cement to the gun. The gun heads are equipped with valves for regulating air and cement discharges. The density of the spray is determined by varying the amount of air and cement discharged through the valves at the gun head. It is claimed that the gun will build up a compact, even, homogeneous wall or patch under all conditions.

New Pressure Feed Airbrush

A new type of airbrush has been placed on the market by the Paasche Airbrush Company, Chicago, Ill. The apparatus, the trade name of which is "Lo-Hi Pressure Feed Airbrush," is said to have a number of important new features which give it distinct advantages over other types of airpainting devices. The chief improvement is the fact that the device is multiplehead with pressure feed attachment, operating on a very low volume of air. Pressures ranging from 6 to 100 pounds can be applied, and a wide range of materials can be sprayed by changing the type of head. Five different types of aircaps in five sizes are supplied with the apparatus.



MULTIPLEHEAD AIRBRUSH

New Aluminum Alloy

The Sheet Aluminum Corporation, Jackson, Mich., has placed on the market a balanced aluminum alloy that is said to be fundamentally new in composition and in application to a wide variety of products, for many of which aluminum has never before been practicable. It is claimed for this alloy that it combines lightness and strength to a greater degree than any other workable product of its kind ever developed on a commercial basis. The new aluminum alloy is known by the registered name of Hyb-Lum, and is protected under United States Patent No. 1,579,481. Prior to the introduction of Hyb-Lum, the alloying elements of aluminum were chiefly copper, manganese, silicon and magnesium. Hyb-Lum departs largely from these elements, employing instead nickel and the metals of the chromium group. The total addition of all heavy metals is approximately two per cent.

Among the outstanding qualities claimed for Hyb-Lum are color, non-tarnishing, non-corrodibility, resistance to inter-crystalline corrosion, chemical resistivity, welding quality, strength and plasticity, non-fatigue, low specific gravity, wide limits of temperature in heat-treatment, and stability after heat-treatment even at elevated temperatures.

Hyb-Lum has a pure white color, somewhat like silver and without the grayish blue cast of aluminum. It takes a brilliant polish. Its non-tarnishing quality has been demonstrated by a polished sheet being kept in chemical laboratory where all kinds of gases were present, often with a large excess of moisture. Hyb-Lum, it is claimed, is only slightly affected by the salt spray and cyclic immersion tests for inter-crystalline corrosion. It is said to resist chemicals better than pure aluminum, weld with gas as well as pure aluminum, and in arc welding is said to be superior both to pure aluminum and other high strength alloys.

Hyb-Lum is manufactured in four different classes—A, B, C and D—but the composition is virtually the same in all, the different physical properties as to strength, plasticity, elongation, bending qualities and workability being obtained by annealing, hard-rolling to different tempers, cold-working and heat-treatment.

It is produced as a heat-treated metal (Hyb-Lum D) that may be used as such, obviating the necessity for users to maintain special heat-treating departments. In cases where finished or semi-finished articles must be heat-treated by a fabricator, the process has been simplified to a very large extent (Hyb-Lum C). Heat-treatment of the alloy consists of quenching in cold water from 900 to 975 degrees F. for a period of from 12 to 24 hours. Hyb-Lum is annealed at from 600 to 1,000° F., so that the temperature ranges in all cases are wide.

Special stress is laid on the fact that such properties of aluminum and its high-strength alloys vary directly with the amount of hardrolling or cold-working the metal receives in the processes of fabrication. In addition to strain hardening or cold-working, the higher strength forms require heat-treatment and aging. Hyb-Lum does not differ in this respect.

The elongation of a given alloy varies inversely with the amount of cold-working performed upon it and, therefore, generally speaking, with its tensile strength. An exception to this statement exists in those instances where heat-treatment tends to restore a part of the lost elongation while at the same time it increases the tensile strength.

Hyb-Lum A is a general purpose alloy, suitable for all customary drawing and forming operations. It cannot be heat-treated. It is supplied in different tempers.

PHYSICAL PROPERTIES OF HYB-LUM A

Temper	Yield Point	Ultimate Strength	% Elongation	Ericksen	Scl.	Brinell
Soft ...	14,000-16,000	24,000-28,000	10-15	8-10	9-11	45
Hard ..	35,000-40,000	40,000-45,000	2	0	35	70

Hyb-Lum B is a lighter alloy for deep drawing where strength is not of primary importance. It cannot be heat-treated.

PHYSICAL PROPERTIES OF HYB-LUM B

Temper	Yield Point	Ultimate Strength	% Elongation	Ericksen	Scl.	Brinell
Soft ...	12,000-14,000	20,000-24,000	18	9-11	9-11	40
Hard ..	30,000-35,000	32,000-36,000	2	0	30	65

An interesting variation of Hyb-Lum B has been developed by the addition of magnesium (Hyb-Lum B C). This alloy has an unusually high percentage of elongation and may be heat-treated. It is intended for use where a heat-treated alloy with excellent drawing properties is required.

Hyb-Lum C is partly heat-treated, and is supplied quenched but not aged. In the quenched state it has the physical properties of Hyb-Lum A soft. It is recommended for all structural work and for drawing that is not too deep. It will bend 180 degrees flat. Hyb-Lum C quenched is prepared with the expectation that the user will age the fabricated product.

Hyb-Lum D is completely aged, and its strength is in inverse proportion to its ductility. It is supplied in three tempers: soft, medium and hard.

PHYSICAL PROPERTIES OF HYB-LUM D

Temper	Yield Point	Ultimate Strength	% Elongation
Soft	35,000	40,000	8-10
Medium	45,000-50,000	50,000-55,000	3
Hard	55,000-65,000	55,000-65,000	0

Hyb-Lum D soft, bends 180 degrees flat; medium, bends 180 degrees flat in thin sections; hard, cannot be formed.

Use of Hyb-Lum D is indicated for formed structural members and other purposes where strength is desired but operations other than bending are not required. Its advantage over Hyb-Lum C lies only in the fact that it does not require heat-treatment by the user.

Hyb-Lum products comprise flat, coiled and strip sheets, sheet circles, extruded structural and special shapes, moldings, bars and rods, wire and rivets, stampings, screw machine products and forgings. All of these are furnished heat-treated if desired. In addition, ingots for die castings, permanent mold and sand castings are supplied.

Equipment and Supply Catalogs

Bronzes and Special Brasses. Taunton-New Bedford Copper Company, Taunton, Mass.

MT Control for Direct Current Mill and Crane Motors. General Electric Company, Schenectady, N. Y.

Index of Publications. Policyholders' Service Bureau, Metropolitan Life Insurance Company, New York City.

Waukesha Nickel, the Lifetime Metal. Waukesha Foundry Company, Waukesha, Wis. Booklet on brass, aluminum and nickel.

Here's Where and Why. E. Reed Burns and Sons, Inc., 21 Jackson Street, Brooklyn, N. Y. Pamphlet on polishing, buffing and plating supplies.

Chromium Plating, the New Decorative Finish. W. Canning and Company, Birmingham, England. Booklet describing methods and equipment.

The Foreman and Labor Turnover. Policyholders' Service Bureau, Metropolitan Life Insurance Company, New York City. Labor Turnover Series, No. 3.

Brown Resistance Thermometers. The Brown Instrument Company, Philadelphia, Pa. Catalog No. 93, describing resistance thermometers for measuring temperatures from $300° F. to +1000° F., indicating, recording and controlling.

American Electric Motors. American Electric Motor Company, Cedarburg, Wis. Bulletin 101, illustrating the uses of this company's motors in various industries and under varying operating conditions; Bulletin 102, a general description of various types of motors, advantages of each, and method of manufacture.

Birmingham Jewellers' and Silversmiths' Association Buyers' Guide. Published by the association named, at 27 Frederick Street, Birmingham, England. A 148-page book, handsomely bound in boards, containing a great many advertisements, a list of officers of the association, a speech by the Prince of Wales, a buyers' guide which is very complete and exhaustive, covering all branches of the British jewelry trade, and a vocabulary of trade terms. Everything in the book except the advertisements is translated from the English into French, Spanish and Portuguese. The association is allied with, and under the same direction as, The Gold, Silver, Electro-Plate and Allied Trades Manufacturers' Federation (of Great Britain).

Associations and Societies

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

Institute of Metals Division

HEADQUARTERS, 29 WEST 39th STREET, NEW YORK CITY

PHILADELPHIA MEETING

The Institute of Metals Division, American Institute of Mining and Metallurgical Engineers, will hold its fall meeting at Philadelphia in the same week that the American Society for Steel Treating and the American Welding Society meet. The Institute sessions will be held October 9, 10, 11 at Hotel Benjamin Franklin, which will be headquarters.

PROGRAM

Tuesday, October 9: 9:00 a. m. Registration at Hotel Benjamin Franklin.

10:00 a. m. Technical Session:

Gases in Casting Copper, by O. W. Ellis.

Diffusion of Zinc Into Copper, by S. L. Hoyt.

Less Common Elements in the Electrical Industry, by T. S. Fuller.

Papers on Temperature co-efficient of Brinell Measurements and Hardenable Copper and Silver Alloys.

Wednesday, October 10: 2:00 p. m. Joint Session with A. S. S. T. at Auditorium—Symposium on Metallography.

Treatment and Structure of Magnesium Alloys, by John A. Gann.

Notes on Smoothing and Etching, by H. B. Pulsifer.

X-ray Study of Cold Work and Annealing, by Ancel St. John.

Tempering of Steel, by F. F. Lucas.

Neumann Bands in Ferrite, by C. H. Mathewson.

6:30 p. m. Institute of Metals Division Dinner, at Benjamin Franklin Hotel; speaker, Dr. F. M. Becket, vice-president, Union Carbide Company; subject, Chromium Alloys.

Thursday, October 11: 10:00 a. m. Technical Session at hotel.

Effect of Cold Rolling and Heat Treatment Upon the Physical Properties of Britannic Metal, by B. Egeberg and H. B. Smith.

High Strength Gold Alloys for Jewelry, by E. M. Wise.

Stability of Aluminum and Magnesium Casting Alloys, by A. J. Lyon.

Papers on Permanent Mold Casting.

Vacuum Method for the Casting Metal.

Testing Materials Society

HEADQUARTERS, 1315 SPRUCE STREET, PHILADELPHIA, PA.

WILL STUDY METAL CORROSION

The bulletin of the American Society for Testing Materials states that Committee B-3 on Corrosion of Non-Ferrous Metals and Alloys has announced a comprehensive program in the study of atmospheric, liquid and electrolytic corrosion of a number of types of non-ferrous metals and alloys. To this program has recently been added, upon recommendation of Committee B-2, corrosion studies of die-casting alloys. The committee is engaged in raising a fund of $6,500 to support these investigations and subscriptions amounting to $5,300 have so far been made towards this fund.

Details of the investigation as planned appear in the reports of Committee B-3 for 1927 and for 1928. Further information regarding this work may be obtained from the chairman of the committee, T. S. Fuller, General Electric Company, Schenectady, N. Y., or from any members of the committee in charge of raising the fund, which consists of W. M. Corse, 810 Eighteenth St., N. W., Washington, D. C. (chairman), W. H. Bassett, American Brass Company, Waterbury, Conn.; W. H. Finkeldey, Singmaster and Breyer, 420 Lexington Avenue, New York City; W. M. Peirce, New Jersey Zinc Company, Palmerton, Pa.; Sam Tour, 123 North Street, Batavia, N. Y.

A number of companies still have under consideration the request to subscribe to this fund and it is hoped that the entire sum of $6,500 will soon be raised. The thanks of the Society are extended to all who are lending financial or other support to this important work.

American Electrochemical Society

HEADQUARTERS, CARE OF COLIN G. FINK, COLUMBIA UNIVERSITY, NEW YORK CITY

CHARLESTON-HUNTINGTON MEETING

As previously announced in these columns, there will be a three-day meeting of the Society at Charleston, West Virginia, on September 20, 21 and 22. Headquarters of this meeting, which is really the Fall convention of the Society, will be at the Hotel Kanawha, Charleston, which is large and well equipped for such a meeting.

On Thursday morning, September 20, there will be a scientific and technical session at the Hotel Kanawha. The main topic of discussion will be **Chemical Reactions at 1000°C. and Above.** After lunch, there will be visits to industrial plants in Charleston and vicinity. There will be an informal dinner and "get-together meeting" in the evening.

On Friday morning, September 21, there will be another scientific session at Hotel Kanawha. In the afternoon the members will be taken by special train to the International Nickel Plant near Huntington, about fifty miles distant. According to B. H. Jacobson, Chairman of the Local Committee, "the trip to the nickel plant promises to be one of the most interesting features. Their plant is ideally laid out and it will be possible for every one to follow through the complete smelting, rolling, and plating operations in about two hours' time." The group will be brought back to Charleston in time for an informal dinner at the Hotel Kanawha. In the evening, there will be an old-fashioned Southern smoker at the Edgewood Country Club.

The session on the electrodeposition of copper, chromium, nickel, tellurium and graphite will be held Saturday morning, September 22. Saturday afternoon has been kept open for special trips that are being arranged.

National Safety Council

HEADQUARTERS, 108 EAST OHIO STREET, CHICAGO, ILL.

METALS SECTION OF SAFETY CONGRESS

Members of the National Safety Council's Metals Section will get together at a roll-call luncheon, which will be held on October 1 in the Waldorf-Astoria Hotel, New York City, immediately following the general meeting of delegates to the seventeenth annual safety congress. There will be no charge for admission and both members and non-members will be welcome.

The community singing at the luncheon will be directed by N. V. B. Zeigler, personnel director, U. S. Aluminum Company, New Kensington, Pa. There will be an address by Dr. Charles Herbert Rust, Worcester, Mass., and reports of the various committee chairmen.

SESSIONS OCTOBER 2

At the morning meetings on October 2, R. M. Roosevelt, vice-president, Eagle Picher Lead Company, will discuss "Safety From the Viewpoint of Management." Dominic Samuels, foreman, Youngstown, O., will lead a discussion of "Safety From the Viewpoint of Supervision."

SESSIONS OCTOBER 3

Nelson H. Kyser, safety engineer, Studebaker Corporation of America, is to speak on "The Correction of Unsafe Practices in Foundries" at the morning session on October 3. Following the election of officers, L. A. Hartley, director, educational department, National Founders' Association, will lead a discussion on "Developing a Safe Human Factor in Our Industries," and A. W. Concord, M. D., plant surgeon, Clairton Works, Carnegie Steel Company, Clairton, Pa., will start a discussion on "The Placement of Men, or What the Surgeon Can Do."

Electrical-Industrial Exposition

HEADQUARTERS, 130 EAST 15TH STREET, NEW YORK CITY

Electrical contractors, wholesalers, retailers and buyers of electrical goods, and all others engaged in the business of distributing and supplying electrical appliances throughout the United States, will have their own trade show in New York City next October, where assembled in one place they may see exhibited and demonstrated the thousands of approved electrical devices used in the modern home and meet face to face the manufacturers or their representatives.

This will be the first electrical trade show ever held anywhere, and it will be nationwide in scope. It will be held on October 17, 18 and 19 in the Grand Central Palace. While it will be the first trade show of its kind ever held, it is not entirely a new venture, as it has back of it the accumulated experience of 20 annual exhibits of the Electrical and Industrial Exposition.

Arthur Williams, vice-president in charge of commercial relations of The New York Edison Company and president of the Electrical and Industrial Exposition, who made the announcement of the trade show, explained that the trade show is an expansion on a national basis of the annual electrical show, with the first three days set apart exclusively for the trade, and the final seven days open to the general or consuming public.

Lead Industries Association

HEADQUARTERS, CARE OF F. E. WORMSER, 25 WEST 43rd STREET, NEW YORK CITY

ASSOCIATION BEING FORMED

An association of lead mining, smelting, refining and manufacturing companies is being formed and, according to present plans, should be formally launched in the fall. Although no name has been given definitely to the organization, it will probably be known as the Lead Industries Association. Some of the larger lead mining, smelting, refining and fabricating companies in North America have already signified their intention of becoming members in the proposed association, and these include the American Metal Company, American Smelting and Refining Company, Bunker Hill and Sullivan Mining and Concentrating Company, Consolidated Mining and Smelting Company of Canada, Ltd., Eagle-Picher Lead Company, National Lead Co., St. Joseph Lead Company, United Metals Selling Company (Anaconda), and the U. S. Smelting, Refining and Mining Company. Many other mining companies and lead manufacturing companies are expected to become members.

In general the association intends to promote the common interests of those engaged in the production or consumption of lead. In detail, the proposed activities of the association embrace the dissemination of accurate information regarding the use of lead products; the collection of statistical information relating to the lead industries and of current value to them; the checking of substitution of lead by other products; and the development of methods for the improvement of the welfare of those engaged in the lead industries. It is anticipated that the association ultimately will be strongly international in its membership and scope.

British Institute of Metals

HEADQUARTERS, 36 VICTORIA STREET, LONDON, S. W. 1, ENGLAND

AUTUMN MEETING

The Institute of Metals held its Autumn meeting at Liverpool, September 4 to 7. A good program of papers was presented and there were a number of plant visits and interesting social activities, including a supper and dance.

The seventh annual Autumn lecture was delivered by F. G. Martin, whose subject was "Non-ferrous Metals in the Shipping Industry." Following is a list of the papers:

Laboratory Experiments on High Temperature Resistance Alloys, by C. J. Smithells.

Corrosion at Discontinuities in Metallic Protective Coatings, by U. R. Evans.

Constitution of Alloys of Aluminum with Copper, Silicon and Iron, by A. G. C. Gwyer.

Copper-Magnesium Alloys, Part 3, by W. R. D. Jones.

Note on Practical Pyrometry, by G. B. Brook and H. J. Simcox.

Eighth Report to the Corrosion Research Committee, by R. May.

Die-Casting Alloys of Low Melting Point, by T. F. Russell and W. E. Goodrich.

Work-Softening of Eutectic Alloys, by F. Hargreaves.

Die-Casting of Copper-Rich Alloys, by R. Genders, R. C. Reader and V. T. S. Foster.

Alpha Phase Boundary of the Copper-Silicon System, by C. S. Smith.

Properties and Production of Aluminum Die-Castings, by S. L. Archbutt and J. W. Jenkin.

Methods for Investigating Alloys of Reactive Metals, by W. Hume-Rothery.

Strength of Cadmium-Zinc and Tin-Lead Solders, by C. H. M. Jenkins.

Note on Treatment of Aluminum and Aluminum Alloys with Chlorine, by D. R. Tullis.

Personals

Henry Toothill

Henry Toothill, veteran Rochester, N. Y., electroplater, the son of John Toothill, one of America's earliest non-ferrous metal fabricators and electroplaters, recently retired from business after more than sixty years of active work. Mr. Toothill is one of "old line" platers and has had some fascinating experiences during his career in the industry. Some of the details of his life can be quoted from a letter which he has written to the Editor of THE METAL INDUSTRY.

HENRY TOOTHILL

"My father, John Toothill, came to this country from Sheffield, England, back in the early fifties. He settled at Wallingford, Connecticut, which even then had become a metal working center. He was what was then termed a 'white-metal smith' and understood the Britannia metal trade thoroughly. He could mix the metal, work it and finish it. At that time this metal was not electroplated.

"I was only a boy at school in those days. My father soon found a connection with a number of prominent men at Meriden, six miles north of Wallingford, who were trying to produce Britannia metal ware. The Wilcox brothers were among these men. They had made some experiments, mostly casting their products as they had been unable to make an alloy that would roll or spin. As soon as they heard of my father they engaged him to make some samples. He produced some articles and from this small beginning grew the Meriden Britannia Company. The metallurgist for this concern was Mr. Babbitt (all Babbitt metal users will recognize this name, as well as most others in industry) and after obtaining a formula for Britannia from my father, he experimented considerably and succeeded in improving the metal. He instructed my father in the art of alloying the soft metal with copper in order to produce a superior quality of Britannia metal.

"A little later my father formed a partnership with his brother, who was a plater. They started business at 47 Ann Street, New York City. When the Civil War broke out, they found it difficult to get men who could satisfactorily perform their work. In fact, there were hardly any men in this country then who knew the business well, so they sent to England for men. Soon they had a good business going, employing about a thousand men! They moved to larger quarters at 40 White Street. Here I got my first plating room experience.

"Silver and gold plating was all we knew anything about. There was no nickel plating then, and there were no dynamos

or regular manufacturers of plating chemicals. We had to use the 'Smee battery' for current and we made our own cyanide of potassium. This was done by fusing yellow prussiate of potash by hand in an iron pan, over a charcoal fire. There was nobody selling this very essential substance. A little later a man named Davis started to manufacture cyanide at Providence, R. I. He founded a good-sized industry.

"Several years passed before we learned anything about nickel, but we had missed very little because the Britannia metal business had not required such finishes. Later came the dynamo, which replaced the Smee battery, and many other innovations which greatly simplified the electroplating art. I used the first dynamo ever installed in a plating plant. This was at the Simpson, Hall, Miller works, at Wallingford.

"I could fill a good-sized book with my experiences in the plating trade. It has always interested me greatly and even now that I have decided to fall out of the active ranks, I shall follow its progress attentively."

There is no doubt that Mr. Toothill has seen a great deal in his time, and done a great deal. He modestly says very little about his own achievements in the electroplating art. It can be stated to his credit that he has always been considered one of the leading experts in his field at Rochester, where he has been in the business for very many years. Let us quote further, this time from the Rochester Union and Advertiser of January 4, 1900:

"A Gold Plated Plow"

"They say that all good things and all smart people are to be found in Rochester. However true this may be, there is one thing sure, Rochester has the best electroplater of the country. When the Syracuse Chilled Plow Company, which is one of the largest of its kind in the world, decided to make an exhibit at the World's Fair they cast about to find some expert electroplater, one who thoroughly understood how to deposit gold on metal and to give it that high polish and finish that only an expert can; their investigations brought them to Rochester and they found in the man they required Henry Toothill at 119 North Water street. Mr. Toothill at once was commissioned to prepare a part of their exhibit for the Chicago fair and so excellent was the work that it attracted the especial attention of thousands who visited the fair and has been taken to all of the exhibitions of note that have occurred since in different parts of the world. The present piece of work is a massive three-horse plow—the blades alone weighing upwards of two hundred pounds, and is so perfectly plated that there is not one particle of exposed surface which is not radiant in burnished gold.

"A 'Union' man who went through the plant of Henry Toothill yesterday was highly entertained with the modus operandi of the electroplating business as it is practiced here. The variety of material that was in process of rehabilitation, or transformation, represented everything that is produced in brass, steel, iron and other metals, and it was hard to believe that all of them would be converted into resplendent articles for practical and ornamental uses. Mr. Toothill has been a conspicuous figure in the world of electroplaters for the past thirteen years, and did good work in the old days when an electroplater had to prepare every chemical that entered into the solutions and baths used. He has found this knowledge valuable to him in many ways. With the beginning of the year there are many improvements under way at his place of business, and he is better prepared than ever to handle all work in electro-deposition in all metals known to science as well as those of everyday use."

Curtiss R. Waters, formerly with the Cambia Clay Products Company, Black Fork, Ohio, is now associated with the Ferro Enameling Company of Cleveland, Ohio.

H. E. Michael, formerly with Fuller and Lehigh Company, Fullerton, Pa., has been added to the engineering staff of The Ferro Enamel Supply Company, Cleveland, Ohio.

J. K. Moses, the dean of crucible salesmen in the New York district, is now conducting the New York office of the Chicago Crucible Company. Mr. Moses is located at 371 Fort Washington Avenue, New York City.

H. F. Guthrie, of the Louisville Enameled Products Company, Louisville, Ky., and formerly with the Mansfield Vitreous Enameling Company, of Mansfield, Ohio, is now associated with The Ferro Enamel Supply Company, Cleveland, Ohio.

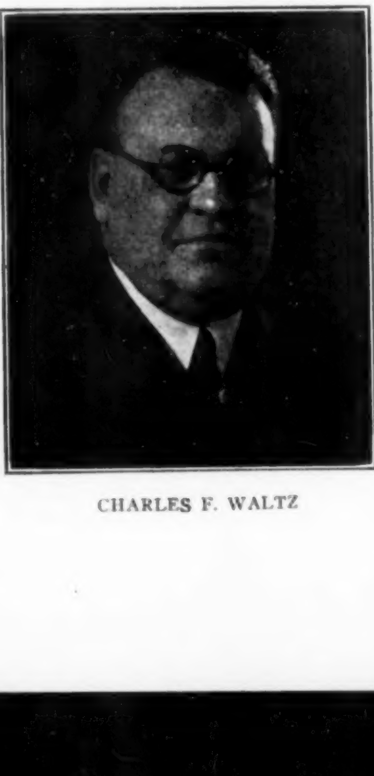
The Henry V. Walker Company of 17 John Street, New York, has secured the services of **Richard Zeller** as forks manager. With seventeen years' experience in all branches of the lacquer industry, Mr. Zeller is well qualified to direct and supervise the manufacture of the varied lines of lacquers, enamels and pyroxylin products manufactured by the Henry V. Walker Company.

Obituaries

Charles F. Waltz

Charles F. Waltz, commissioner of the National Association of Ornamental Iron and Bronze Manufacturers and editor of the Iron, Bronze and Wire Work News, of Cincinnati, Ohio, died as the result of injuries sustained in an automobile accident while visiting at Caroga Lake, N. Y., near Dolgeville.

Mr. Waltz, widely known in the metal trades, was 55 years of age at the time of his death. He was born at Three Rivers, Mich., in 1873. He attended Valparaiso University, graduating in 1898, and then practiced law at Elkhart, Ind. In 1902 he came to Cincinnati, where he organized the Employers' Association of Cincinnati, of which he was secretary for the next ten years. In 1912 he resigned, to become secretary of the Building and Construction Employers' Association of Cincinnati, a new organization. In 1922 this organization united with the Associated Building Industries of Cincinnati and became known as the Associated Building Industries of Cincinnati and Vicinity. Mr. Waltz was still executive secretary of this organization at the time of his death.



CHARLES F. WALTZ

In 1907, in collaboration with H. A. Suydam of Cincinnati, Mr. Waltz conceived and started work toward the organization of the Ornamental Iron and Bronze Manufacturers' Association. At the first meeting of this body, he was elected commissioner, which position he retained until the time of his death.

Major Joseph A. Steinmetz

Major Joseph A. Steinmetz, widely known Philadelphia engineer and inventor, founder and senior member in the firm of Janney-Steinmetz and Company, Philadelphia, Pa., died at his home there on July 11.

Mr. Steinmetz was 58 years of age. As a young man he attended Lehigh University, where he became associated with Professor Langley in the development of airplane motors. He had always been interested in some form of experimental aviation work since that time, as well as in other mechanical fields. He is especially known for his invention of a depth bomb and other devices, including anti-aircraft equipment. He was commissioned during the war and served on the National Research Council. About six months ago, poor health forced Mr. Steinmetz to retire from active participation in the business of Janney-Steinmetz and Company. At the time of his death he was also president of Steinmetz and Company, Philadelphia; a director of the Globar Corporation, Niagara Falls, N. Y.; and he was associated with the Steinmetz Heating Company, New York City. He was a member of the Engineers' Club of Philadelphia, the American Society of Automotive Engineers, the Franklin Institute and the American Electrochemical Society.

Timothy Thompson

Timothy Thompson, a roller in the plant of the Scovill Manufacturing Company, Waterbury, Conn., died on June 29. Mr. Thompson was 63 years of age and had been with the Scovill company for more than 39 years. He was well known and very popular among the employes of the company.

Gustav H. Koven

Gustav H. Koven, president of L. O. Koven and Brother, Inc., 154 Ogden Avenue, Jersey City, N. J., died on Monday, June 11, 1928.

Charles McCarthy

Charles McCarthy, employed by the Scovill Manufacturing Company, Waterbury, Conn., since 1897, died on June 19 after a short illness. Mr. McCarthy was born in Ireland 54 years ago. When he came to this country he made his home in Waterbury, where he became connected with the brass industry.

J. Andrew Strauch

J. Andrew Strauch, purchasing agent for the National Bearing Metals Corporation, St. Louis, and a son of John B. Strauch, president of that company, died recently at St. Louis. Mr. Strauch was born in that city.

News of the Industry

Industrial and Financial Events

Taunton-New Bedford Copper Company

The Taunton-New Bedford Copper Company, Taunton, Mass., declared a regular quarterly dividend of $2 and an extra dividend of $25, both of which were paid August 31 to stock of record August 16.

Another development in this company was the receipt by stockholders of notices signed by President Edward H. R. Revere, advising them of a tentative offer for the purchase of the company by unnamed interests. No definite statement of the nature of the negotiations or the extent of these was included. The possibility of the sale of this concern is especially interesting in view of the fact that it has just rounded out its first century. The company was started in 1826 by Crocker Brothers. Seventy-five years later it consolidated with the Revere Copper Company, founded by Paul Revere of Revolutionary War fame, and with the New Bedford Copper Company, both of which had reputations similar to its own for high grade output and integrity. Edward H. R. Revere, president of the Taunton-New Bedford company, is a direct descendant of Paul Revere. (See The Metal Industry, April, 1928, page 153.)

Great Lakes Plating Buys Big Plant

The Great Lakes Plating and Japanning Company, Harry S. Sandberg, president, has purchased a large factory building at 1715 Dickson Street, with over fifty thousand square feet of space which will be used for finishing metal and wood and will make this company one of the largest job production platers and japanners in the United States. The company specializes in taking over the complete finishing operations of manufacturing concerns in the Chicago district, operating day and night.

The Great Lakes is able to produce chromium, Udylite, gold, silver, nickel, copper, brass and other finishes. Most of these finishes are done mechanically.

The Great Lakes Plating and Japanning Company expects to have all departments in their new building by January 15th, 1929, meanwhile keeping in constant production at the present plant.

International Nickel Company

The common stock of the International Nickel Company, formerly paying a dividend of $2 per annum, in quarterly payments, has now been placed upon a $3 per annum basis by the declaration last month of a regular quarterly dividend of 75 cents, payable September 29. The company issued a statement to stockholders declaring that due to its anticipation of a continued expansion in the demand for nickel, the company's Frood mines, on which development work was started in 1924, have now been reopened and are to be worked steadily, with a view to expanding nickel production in accordance with increased demand.

Babbitt Metal Consumption

The total apparent consumption of Babbitt metal in the United States in July, 1928, based on reports received by the Department of Commerce from 31 firms, was 4,692,825 pounds as compared with 4,731,023 in June and 4,604,786 in July, 1927. This consumption is calculated from sales by manufacturers and consumption by those firms (among them several important railroad systems) which consume their own production.

New Metal Exchange Members

The Board of Directors of the National Metal Exchange, New York City, has approved the election of 43 new members submitted by the Membership Committee. This leaves thirty-three memberships to be filled from the applications now before the committee. President Erwin Vogelsang, who presided at the meeting on August 29, said that when the membership of the Exchange was completed, which it was expected would be by September 10, the Exchange would have representatives of virtually every prominent metal company in the United States and Europe.

The members just elected include:

Pierre Dupasquier	Michel Masquelier
M. Golodetz	Victor Mairesse
Loachim Ginzberg	Tony Sauquet
Charles P. Hull	R. Levu-Simons
William S. Murphy	Pierre Egloff
Lucien Lerat	Gustave Reinhart
H. Edgar Robinow	Jean Wagner
F. R. Rosenbaum	Henri d'Erceville
Adolph Rimberg	William Prior
Jacob Aron	Walter Fletcher
Edward J. Wade	J. L. Little
Jules Pavitt	John F. Bailey
Paul H. Hemelryk	David F. Engel
Frederick J. Herzog	E. Leuders
A. D. R. Collie	W. J. Butterfield
Joseph G. Clayton	Robert A. Gill
Noel Bartholomew	Hans Bernstorff
A. Schadegg	Alvin V. Filer
Charles Kronheimer	A. H. Lamborn
Jean J. Speiser	Joseph A. Sisto
Jacques Westphalen	Norris B. Renrotin

Federated Metals Corporation

The Federated Metals Corporation, New York, dealers and reclaimers of scrap and waste metals, reports for the six months ended May 31, 1928, net profits of $288,853 after interest and depreciation, as compared with $10,732 in the same period of the preceding year and a net loss of $729,729 in the 1926 period.

Reynolds Metal Company

The Reynolds Metal Company has been organized to take over two companies manufacturing temperature control apparatus and two which manufacture tin foil. These are the Robert Shaw Thermostat Company, the Fulton Sylphon Company, the United States Foil Company and the Beechnut Foil Company.

Business Reports of The Metal Industry Correspondents

New England States

Waterbury, Conn.

September 1, 1928.

The Scovill Manufacturing Company of this city is cited as one of the most progressive concerns in New England in the initial bulletin put out by the research committee of the New England Council, entitled **The Use of Research in Developing Old Products and Introducing New Ones.** It states that the local concern has adopted three effective ways of improving its products; first maintaining a uniformly high grade of raw metal; second, constantly overhauling and renewing its mechanical equipment and third by continuous development work carried on in a research laboratory—the company was one of the first to experiment with the use of oil furnaces for brass casting and also pioneered in the installation of electric furnaces, now used almost exclusively in the plant; automatic machines are investigated as soon as they appear on the market and many such machines are designated and built at the plant; the worth of such machines is first ascertained in the experimental department and if found to be sufficient, the machine is transferred to the production department. Formerly it was practically impossible to secure quality etching on curved surfaces, but through laboratory research the company has found a method of obtaining this result, the bulletin states.

Lewis E. Van Norman, commercial attache of the consulate at Bucharest, Rumania, and formerly in consular offices in other parts of the world, addressing the local Rotary Club last month, said he had seen Waterbury products such as watches, clocks, buttons, plumbing fixtures and other metal goods in every city of the world in which he has been located. He spoke on **More Export Trade for Waterbury Manufacturers.**

Patents during the past month have been granted to local men as follows: **Daniel Francis,** assignor to the **Waterbury Tool Company,** handwheel and locking device for speed gears; **Philip A. Reuter,** assignor to the **Scovill Manufacturing Company,** decorating metal articles; **Charles F. Beardsley** and **A. T. Smith,** assignors to the **Beardsley and Wolcott Manufacturing Company,** combination lamp and smoker's stand; **John Galat,** automatic fastener; **Delmar C. Kinnear,** assignor to the **American Brass Company,** metal-drawing apparatus; **John Robson,** assignor to the **Universal Engineering Corporation** of Montreal, power plant for self propelled vehicles; **Theodore Russell,** assignor to the **J. M. Russell Manufacturing Company,** manufacture of sheet metal chains.

William Kendt, 44 years old, of Highland Avenue, was killed at the **Benedict and Burnham** branch of the **American Brass Company** on August 14, when he was pinned against steel girders by a 12 ton crane. Kendt, a millwright, was inspecting the crane rails and neglected to remove the safety plugs which if he had done so would have checked the crane.—W. R. B.

Bridgeport, Conn.

September 1, 1928.

Permits have been issued for the construction of a $275,000 office, laboratory and foundry addition to the **United States Aluminum Company** plant in Fairfield, just outside of this city. It will be in three units of brick and steel construction. Plans were prepared by Clark & Arms of New York and the general contract went to C. A. Fantz of Pittsburgh. The building will be of one and one-half stories with 625 foot frontage and 250 foot depth. The present plant is now working 20 hours a day under crowded conditions and the officials report that the volume of business is increasing rapidly.

The Bullard Machine Tool Company during the first half of the current year did more business than during the entire year of 1927, **President E. P. Bullard** announces. It is operating on full time schedule and has sufficient unfilled orders booked to maintain operations at capacity for a number of months. He says: "Development of new machinery, complete modernization of manufacturing equipment and a progressive sales campaign are responsible for the favorable condition."

Manufacture of electric refrigerators by the **Home Products, Inc.,** will start within the month in the two four-story buildings leased by the company from the **Remington Arms Company.** Floor space of 126,000 feet is being utilized and new machinery is being set up. **James Fleischman Holmes,** grandson of Julius Fleischman, is president of the company and **John F. Plummer,** for years head of the New York office of the **Locomobile Company** of this city, is vice-president and general manager. **J. H. Sturges** of Fairfield is secretary and **H. L. Shields** of this city is treasurer. The refrigerators will be built under Westinghouse patents.

Isaac L. Ferris, works manager of the **Bridgeport Metals Company,** spoke on the growth of the brass industry at the meeting of the Exchange Club last month. It had its birth in Waterbury in the desire to make buttons from sheet brass locally instead of importing them from England, he said. The predecessors of the **Scovill Company** made the first buttons and although that company continues to make them, they comprise only a small part of their present business. If they manufactured them now in the same proportion as at the beginning it would take 42,000 hands to turn out the product. The Civil War stimulated the industry through the manufacture of cartridges. The invention of brass works as a substitute for wooden works in clocks was another stimulant as was the substitution of brass burners and lamps for candles and still later, the development of electric lights. The development of the Bridgeport Brass Company, the Bryant Electric Company and the Harvey Hubbell Company of this city and of the American Brass Company was sketched. He said that each time when the manufacturers had reached the conclusion that the use of brass had reached its limit, new improvements and inventions increased its use. The use of brass pipe in homes has increased 600 percent in the last 10 years, he said.

Establishment of an airplane manufacturing plant in Lordship Meadows is expected as the result of conferences in this city by **F. Trubee Davison,** Assistant Secretary of War, in charge of aviation. **Igor Sikorsky,** president of the **Sikorsky Manufacturing Company,** and local and state figures such as **Harry O. King,** president of the **Bassick Company,** and **Governor John H. Trumbull.**

Edward S. Godfrey, receiver of the H. F. Holbrook-Henry Brewster Company, has applied for permission to sell the company's plant here, which has been the subject of litigation for 20 years. The plant at one time was operated by the **Bellmore Armored Car Company,** which went into bankruptcy, although all the armored cars now in use in the country are said to have been built under patents of Mr. Bellmore. The last owners built bodies for the **Locomobile Company** and the **American Car Company.**—W. R. B.

Connecticut Notes

September 1, 1928.

HARTFORD.—Directors of the recently organized **Veeder-Root Company** have declared the initial quarterly dividend on the stock, amounting to 62 cents a share payable August 15th to stockholders of record July 31. The next dividend is expected to be at the rate of 63 cents a share, the idea being to escape the fractional penny inconvenience. Satisfactory business volume and favorable outlook are reported.

The Royal Typewriter Company reports business during the first six months of the year as the best in the company's history. It is operating on a full time schedule and since January 1 more than 200 extra hands have been added making the present force 3,000. Construction of a new addition has been commenced which will increase production capacity 25 per cent.

The Pratt and Whitney Aircraft Company is turning out five times as many engines in its local plants as it was a year

ago. Its "Wasp" and "Hornet" engines are being used extensively by both the army and the navy. Recently the navy, finding the engines successful in other aircraft divisions, decided to use Pratt and Whitney "Hornets" for its P. N. patrol planes. **The Boening Airplane Company** of Seattle is also using "Wasp" engines for its new fighter planes for navy use.

Business of the **Underwood-Elliott-Fisher Company** for the second quarter of the year is reported to be somewhat greater than for the corresponding quarter of 1927. Bank loans as of December 31 amounting to $3,620,000 have been reduced to $1,000,000 without impairing cash balances.

NEW BRITAIN.—The financial report of **North and Judd Manufacturing Company** for the year ending June 30 shows a surplus of $719,899 compared to $624,899 a year ago, resources of $3,368,629, which includes a valuation on plant and equipment of $1,620,666 and earnings during the year after deducting reserves for taxes and depreciation of over $345,000. In dividends the company paid $250,000. At the annual meeting last month the following directors were reelected: A. J. Sloper, George C. Clark, E. M. Wightman, F. M. Holmes, F. S. Chamberlain, Samuel McCutcheon, Noah C. Rogers, C. F. Bennett, and H. L. Judd. They reelected the following officers: President, F. M. Holmes; vice-president and secretary, E. M. Wightman; treasurer and assistant secretary, Samuel McCutcheon; assistant treasurer, F. J. Ward.

The **Stanley Works** were closed from August 18 to August 25 for the annual vacation for the workers. The **Corbin Screw** plant also shut down for a week at the same time.

Bennis S. Brown, formerly an officer of the **P. and F. Corbin Company,** died last month at Hot Springs, Ark., at the age of 65. He leaves a sister, Mrs. Mary Martin of Gloucester, Mass.

STAMFORD.—**The Yale and Towne Manufacturing Company** reports for the quarter ending June 30 net income of $451,790 after depreciation and federal taxes, equivalent to $1.03 a share (par $25). This compares with $373,089 or 93 cents a share on the stock outstanding at the end of the previous quarter and $527,413 or $1.32 a share on the stock outstanding in the second quarter of 1927.

TORRINGTON.—**Constant Bouillon** of this city has been granted a patent on a manual feeding mechanism for machine tools and **Thomas W. Bryant,** a patent on a golf club.

WINSTED.—**The Gilbert Clock Company** reports conditions at present as follows: "The earlier part of the year there seemed to be a period of hesitation. Gradually, however, this has led to improved conditions and at present our business is running ahead of last year. So far as we can see in the clock industry we do not see that there is going to be any further weakening in prices. With the possibility in view of increasing cost of raw material prices may tend slightly higher. We believe stocks of goods on hand are normal and possibly a few percent above normal on some items. We find our customers' buying is reasonably conservative and a good deal of hand to mouth basis. This, however, has its good points as well as bad. We view the prospects for a substantial and satisfactory fall business as very good and do not believe the election will interfere in any way with a satisfactory increase in business."

George Sweet, 31 years, died following burns received in an explosion at the **Winsted Insulated Wire Company's** plant on July 24. A fire followed the explosion which did slight damage to the plant.

MERIDEN.—**The International Silver Company** showed net earnings, after preferred dividend requirements of $1.47 a share on 91,200 shares of common for the last quarter compared with $1.43 a share in the previous quarter and $2.80 a share for the second quarter of last year.

SOUTHINGTON.—**The Southington Hardware Company** at its annual meeting last month reelected the following directors: James H. Pratt, Charles E. Smith, Bradley H. Barnes, Hon. Marcus H. Holcomb, Edwin S. Todd, William E. Smith and P. E. Viering. Officers were reelected as follows: President, James H. Pratt; secretary-treasurer, William E. Smith. The usual dividend of 1½ percent was declared.

KENSINGTON.—Work has been started on the new building being erected by the **Goss and DeLeeuw Manufacturing Company.** It is 100 by 175 feet and triples the floor space of the present plant. It will be one story of brick and glass with steel sash and frame. Special machinery for making multiple spindle automatic chucking machines will be installed. It will be ready by the last part of November.

NORWALK.—At the annual meeting of the **Gilbert and Bennett Manufacturing Company,** makers of wire netting and wire cloth, the following officers were reelected: President, Samuel J. Miller; vice-presidents, Charles J. Miller, David H. Miller and Edward S. Jones; treasurer, William H. Hunter, secretary, D. Henry Miller.

—W. R. B.

Middle Western States

Detroit, Mich.

September 1, 1928.

The Detroit and Michigan territory is just entering into one of the most prosperous periods in its history, it is generally believed by both financial and industrial interests. General business continues to move with more animation than is characteristic of the summer season, according to a recent survey. Financial and industrial experts have similar forecasts to make.

Detroit plants of all kinds are engaged more extensively now than at any time in the history of the city. If manufacturing continues at the present rate, the question is being asked, what will it be during the late fall and winter when all lines are usually at their best? More persons are now working in the metropolitan district of Detroit than ever before and, according to reports from the Manufacturers' Association, each week shows an increase.

The foregoing condition is particularly applicable to manufacturing in the brass, copper, aluminum and gray iron industry. Motor plants are now going practically full speed, with the best months of the year still ahead.

Nearly everyone had thought the old time boom periods had passed forever, but if conditions continue as they have been during the last few weeks, greater manufacturing activities may be witnessed than ever before.

Welden **Products Company** has recently been incorporated in Detroit for the purpose of engaging in a general manufacturing, welding, heat treating and finishing business. The stockholders are L. M. Lawton, William Blakley and H. B. Lawton, 6560 Epworth Boulevard, Detroit.

The Detroit Insulated Wire Company is a new corporation in Detroit. The owners are J. A. Sundstrom, A. S. Whiston and A. C. Bradd, 5899 Cadillac Avenue, Detroit.

Net sales of the **Detroit Vapor Stove Company,** Detroit, for the six months ending June 30, were $1,248,597; and net earnings after interest, taxes, and depreciation, but before federal taxes, were $155,338.

The Higgins Brass Manufacturing Company, Detroit, has let contracts for a large factory addition. G. V. Pottle is the architect.

The Industrial Welding and Metal Company is a new concern recently incorporated at Detroit. Present headquarters are at 1024 First National Bank Building.

Kreighoff Company has been awarded the contract for remodeling of the building on East Grand Boulevard, Detroit, for the **Bohn Aluminum and Brass Corporation.** The architect is C. W. Brandt. The **Bohn Aluminum and Brass Corporation** reports for the six months ending June 30 a net profit of $1,644,089, after charges and federal taxes equivalent to $4.70 a share on 350,000 no par shares of stock.

The Industrial Metal and Welding Company, 1024 First National Bank Building, has been incorporated in Detroit. It will manufacture and deal in welding flux, foundry flux, welding rods, metals, etc. The capital stock is $10,000. The stock-

holders are Frank E. Elge, Gunnar E. Kardstrom, and Anthony Nelson.

Construction work has been started on the new foundry unit of the **Oakland Motor Car Company** at Pontiac, Mich. The plant is to be ready for occupancy by December 15, according to **L. A. Blackburn,** resident engineer. The general contract is said to amount to more than $400,000.—F. J. H.

Toledo, Ohio

September 1, 1928.

Much optimism is heard in the Toledo territory regarding prospects in the non-ferrous metal field. The early part of the summer has shown moderate activity, but now it looks as if the remainder of the year was going to show gains from month to month. Most of this activity may be traced to the motor car industry. Continued activity in this line is proving a surprise to everyone. Although this is the time of year when a dull period may be expected, conditions are just the opposite. Practically every plant in the non-ferrous metal field has been going strong for the last several weeks. Orders are more numerous and some plants are now all fixed for several months ahead.

It looks now as if the coming winter will be fully as active as any similar period for the last several years. Much of the activity can be traced back to demands from the motor car industry.—F. J. H.

Other Countries

Birmingham, England

August 15, 1928.

Statistics of hardware exports sent to the Continent through Harwich via Antwerp and Rotterdam show that a large increase has taken place in the exports of brass and copper tubes, metal sheets, and a variety of brass stampings and hardware goods. Business in enamelled goods has to some extent passed into the hands of Scotland.

Great progress has been made in the business of chromium plating, for which certain firms have lately adopted special apparatus. The chromium has the advantage of being a metal which can be electrically deposited, giving great lustre and beauty of color. Housewives are becoming very much impressed with its utility because of its labor saving qualities and the demand for motor car, charabanc, omnibus and tram fittings increases daily. For motor parts it is rapidly supplanting various forms of copper, bronze, brass, etc. Cadmium plating is almost a new industry and has been found very effective as a protection for steel against rust. Very largely cadmium is taking the place of zinc or tin. Switch parts, accumulator terminals, control gear, and other electrical apparatus are utilizing cadmium, and automatic weighing machines, spring balances and the like are other subjects of treatment. One of the largest Birmingham establishments has laid itself out for the supply of apparatus for dealing with cadmium in this way.

The Birmingham Chamber of Commerce is making elaborate preparations for the British Industries Fair which is to be held from February 18 to March 1, next. Although this is six months ahead, less than 10,000 square feet of stand remain to be allotted. In the electrical section alone 63 firms have applied for the same space, namely 21,000 square feet, which was occupied last February by 84 firms. The Management Committee has decided to ration exhibitors, with the result that in many instances reduced space will be allotted. It has been found that unlimited extension may defeat its purpose eventually, in rendering exhibition more difficult while adding to the labor involved in touring the show.

Most of the metal rolling mills took a full week's holiday at the beginning of August for repairs. The trade has become rather quieter, shipbuilding works not having placed any considerable business. While there is a lot of work coming forward for water tubes, competition with Germany has become rather keen.

A gradual improvement in the button trade is reported since the import duty of 33½ per cent took effect three months ago.

The report of the Guardians of the Standard of Wrought Plate in Birmingham relative to the gold and silver wares assayed during the year ended June 30 shows a decided improvement. More silver wares were marked than in any year since 1920 if the aggregate weight be taken as the basis of comparison. Nevertheless, the figures compare badly with the number of the pre-war years.

The feature of the non-ferrous trade is the rapidly extending range of alloys which have become possible and of which advantage has been taken. Nowhere is this shown more than in the shopfitting trade which continues extraordinarily active. Many firms devoting themselves to this class of work have been working overtime for months, and the fastidious taste of shopkeepers is being shown by the readiness with which they are ready to scrap a shop, although in good condition, in order to indulge some fad of taste.

The metallic bedstead trade has shown some revival lately, although wooden bedsteads continue formidable competitors. For certain tropical markets, metallic bedsteads maintain their popularity, especially in areas where combined heat and moisture constitute special difficulties.

Employment in the brass trade has shown some falling off of late and there are more men out of work than for some time, but from the labor point of view this is attributed rather to the adoption of labor saving methods than to any reduction in output. The general tendency is to extend the use of turret lathes and to employ what is called semi-skilled labor. Very few casters are now required as compared with work under the old conditions.—J. H.

Business Items--Verified

Ferro Enameling Company, Keith Building, Cleveland, Ohio, has awarded the contract for a two-story plant addition, 54 x 66 feet.

The Aluminum Goods Manufacturing Company, Manitowoc, Wis., plans to expend about $450,000 on the enlargement of its plant.

Paxton Mitchell Company, Omaha, Neb., has erected and put into operation a new foundry building, 93 x 160 feet in area, greatly expanding the company's production.

Noma Electric Corporation, 334 Hudson Street, New York City, suffered damage to part of its plant by fire on July 22. the company manufactures lighting fixtures and similar equipment.

Club Aluminum Utensil Company, Chicago, Ill., reports net income of $953,530, after charges and federal taxes, for the year ended June 30, 1928. This compares with $804,105 earned in the preceding fiscal year.

The Brass and Copper Sales Company, St. Louis, Mo., has purchased property in St. Louis where a warehouse is to be erected for the purpose of distribution of products of the Rome Brass and Copper Company, Rome, N. Y.

Benedict Metal Works, Inc., 1654 Webster Avenue, New York City, has been placed in involuntary bankruptcy by a petition filed by attorneys for the Nassau National Bank, Brooklyn, N. Y., with a claim of $18,000, and the Elem Coal Company, New York, for $29.

Waterbury Fastener Company, Waterbury, Conn., has increased its capital stock from $50,000 to $250,000 and has covered the increase by an issue of common stock of $100 par value per share. The remainder of the capitalization is covered by preferred stock of $100 per share par value.

The employes of the **Chandeysson Electric Company,** St. Louis Mo., and of the **Pan Electric Manufacturing Company,** of the same city, held a basket picnic at the Wabash Club, St.

Louis, on August 18. The day was spent enjoyably, with such events as swimming, tennis, baseball, cards, dancing and other social activities providing fine entertainment.

The **Hollow Metal Construction Company,** Falconer, Pa., recently incorporated to take over the former plant of the Supreme Furniture Company at that city, has been reorganized. The following are now the officers: John H. Wright, president; Charles J. Swanson, vice-president; Emil A. Peterson, secretary and treasurer. The company will manufacture adjustable metal partitions. It has 61,000 sq. ft. of floor space.

Hanson-**Van Winkle-Munning Company,** Newark, N. J., manufacturers of electroplating equipment and supplies, has purchased the plant of the **Wickham Company** at Matawan, N. J., adjoining the Munning plant there. The Wickham plant was recently vacated and the two plants will be remodeled.

The **Metal Finishers Machine Company,** Cleveland, Ohio, designers and builders of automatic and electric controller strip and sheet polishing machines, have discontinued their demonstrating department at 4001 West 25th Street, for the reason that the various branches of the industry are now supplied with machines. Arrangements have been made with the Ohio Ice Machine Company, 1935 West 47th Street, to build all machinery.

The northwest sales office of the **John Finn Metal Works** of San Francisco, Cal., has been removed to 1934 Railroad Avenue, Seattle, Wash., from its former location at 323 Colman Building, Seattle. The Seattle office is in charge of **C. C. Finn,** northwest manager. The company, according to Mr. Finn, deals in babbitt metal, solders and type metals, and is also operating, at San Francisco, a babbitt metal shop, galvanizing plant, sherardizing plant and a plant for the manufacture of zinc dust.

Review of Wrought Metal Business

By J. J. WHITEHEAD,
President, Whitehead Metal Products Company of New York, Inc.

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

September 1, 1928.

In the Spring months of this year the manufacturers of brass and copper fabricated shapes were holding to the opinion that during the Summer and until Fall there would probably be a fair volume of business offered but because of possible disturbances in the business world generally, nearly all were inclined to be conservative in their predictions and most of them were of the opinion that a slight recession might be a reasonable thing to expect. It would have been difficult a few months ago to find anyone willing to prophesy that August would be a record-breaking month, but that is nevertheless true of many of the eastern brass and copper mills. The demand for sheets, rods, tubes and wire has been very large among almost all classes of consumers of these materials. As a result, many mill departments have been running in two shifts and shipments in August totaled the largest for the year thus far. Consumption of brass pipe and sheet copper has been especially heavy in the building trade. In the eastern cities thousands of new homes have been erected and in practically all of them the plumbing and metal work are of brass and copper. Inasmuch as nearly all of these homes are sold as soon as finished, the builders are continuing their operations so that there is no falling off in demand from this line indicated as yet.

The price position has been steady and firm, influenced largely by the continuing regularity in the quotations for ingot copper. This factor has removed entirely the element of speculation, established confidence, and by influencing buyers to confine orders to their actual requirements has kept the industry healthy.

The business in nickel, Monel metal and nickel alloys continues active and in large volume, on a level with July which established a new high record for all time. Two of the largest department stores in the country, the Bamberger store at Newark, N. J., and the J. L. Hudson Company store in Detroit, are installing new restaurants, the kitchens of which are equipped with Monel metal, Bamberger's is using about fifteen tons and Hudson's about seventeen tons of sheets.

After exhaustive tests, the cities of Denver and Philadelphia have both specified Monel metal markers for traffic lanes. They have placed orders for approximately sixty thousand of these markers.

The advertising campaigns on copper, brass, nickel and Monel metal will all be continued and expanded with the beginning of the Fall. Having passed the period when a slump might reasonably have been expected, the important factors in the industry are all expecting a further expansion of business through the balance of the year.

Metal Market Review

By R. J. HOUSTON,
D. Houston & Company, Metal Brokers, New York

WRITTEN ESPECIALLY FOR THE METAL INDUSTRY

COPPER

SEPTEMBER 1, 1928.

Trade developments have been favorable to a strong copper situation. Prices have therefore reflected the soundness of prevailing conditions and were consistently firm during August at 14¾ cents delivered to Connecticut Valley points and 15 cents c.i.f. European ports of delivery. Sales were in substantial volume, although the bulk of orders were quietly placed without creating any unusual market commotion. The stabilizing forces now in control have been effective in giving steadiness to market values.

Consumption of copper is sufficiently great to take care of the entire output of mines and smelters. Not only has current refined production been absorbed, but the visible supply of marketable copper in stock has been reduced. The month closed firm at 14¾ cents Connecticut Valley delivery and 15 cents c.i.f. Europe.

ZINC

The zinc market has held at the steady and uniform price of 6.25c East St. Louis and 6.60c New York delivery. This condition has existed for many weeks, and the freedom from price fluctuations is becoming a fixed feature in connection with the business. Consumption is large and pending business is promising but recent orders were on a moderate scale. More active demand is expected to develop in September. Stocks of zinc in smelters' hands decreased 2,258 tons in July, the quantity in primary hands August 1 being 42,210 tons. The production of slab zinc in July amounted to 50,890 tons, and the total shipments for the month to 53,148 tons. These were the largest deliveries in eleven months, with the exception of last March when they reached 55,642 tons.

TIN

Active markets and heavy sales, both domestic and foreign, were outstanding features in tin recently. The statistics for July showed that the world's visible supply had increased during that month 1,791 tons. Despite that fact, however, the impression appears to prevail that the high rate of consumption will eventually offset a temporary increase of stocks. Total deliveries of various grades of tin for the first seven months of 1928 were 71,440 tons, against 68,672 tons in the same period in 1927, an increase of 2,768 tons. Increased production and record-breaking shipments from the Far East have lifted total supplies for the seven months ended July 31, 1928, to 73,729 tons, as compared with 67,723 tons for the corresponding period in 1927, being an increase of 6,006 tons. Total visible supply on August 1 was 18,022 tons, against 16,231 tons on July 1. Market at this writing was easy at 45¾c to 46¼c for

September delivery. Recent buying by consumers was in heavy volume.

LEAD

A broader buying interest and heavy sales of lead developed recently which gave more strength to the market. Prices were accordingly marked up to 6.30c New York and 6.10c East St. Louis. This advance was the first since July 9 and was in line with expectations for some time. There was an active demand for prompt and September shipment, and it was easily a sellers' market as soon as the price trend was reversed. Producers are well sold, with large requirements coming from both eastern and western consumers. Higher London quotations helped the tone here and buyers concluded that the time for quick action had arrived. The advance in price on August 23 was the ninth change in quotations this year as compared with twenty-nine price changes in 1927. Lead production in the United States for the first half of 1928 amounted to 320,525 net tons, showing a decrease of 30,006 tons in comparison with the output for same period in 1927.

ALUMINUM

Aluminum is in good demand at the unchanged basis of 24.30c for 99% plus virgin grade and 22.30c for 94% plus quality. There is no special trend to the market and prices are as stable as American liberty. Consumption in its various divisions is absorbing the metal freely and indications point to heavy requirements during the balance of the year. Reports from the automobile factories are favorable for an excellent demand from this class of consumers. Other manufacturing industries are also showing important consuming interest. New business is expected to develop at a satisfactory rate from the various groups of aluminum users. Stocks in bond on July 1 amounted to only 3,955,509 pounds, the lowest since December 1, 1926.

ANTIMONY

There was a fair amount of business in antimony during August. The market also showed evidences of growing strength, and at the close Chinese regulus was quoted at 10⅜ cents duty paid as against 9¾c to 9⅞c earlier in the month. China shipments were firmly held but consumers were disposed to confine operations to hand-to-mouth buying. Official returns of imports are only available up to June, and for that month they amounted to 2,317,786 pounds as against 1,730,212 pounds in May. Substantial stocks are carried here, but they are not pressing on the market at current prices. June deliveries were on a large scale, and if July and August deliveries continue at same rate the trend of the market is likely to be upward.

QUICKSILVER

Market prices for Quicksilver had a sharp rise in the first half of August, and transactions were made at $125 per flask. A stronger tone developed later and the present quotation is $126.50 for 76-pound flasks. European prices are on a higher basis. Stocks in bond on July 1 were reported at 453,156 pounds.

PLATINUM

Refined platinum is a little easier at $75 per ounce. Business is of routine nature, with no special development to stimulate prices.

SILVER

Silver lost some of its market strength last month, and near month-end was quoting 58½ cents per ounce. There was a fair demand at intervals, but requirements were not important enough to develop strong movements. China operated as both buyer and seller and India showed some interest when prices receded. Recent stocks of silver in Shanghai were large and showed a substantial increase over quantity at beginning of August.

OLD METALS

There was a substantial demand for copper and brass scraps during August, and selected material moved freely in consumption. New scrap brass has also been in steady demand for domestic consumption. There was some export interest, but buyers for foreign shipment were rather conservative in accepting offers. There was a slight easing of the market on old copper at month end, and sellers were more anxious for business. The lead grades were firmer on the advance in new metal. Dealers are buyers on the basis of 12¼c to 12½c for heavy copper, 10¾c to 11c for light copper, 7c to 7¼c for heavy brass, 10c to 10¼c for new brass clippings, 5¾c to 6c for light brass, 4¾c for heavy lead, 3¼c for old zinc, and 16¾c to 17c for aluminum clippings.

Daily Metal Prices for the Month of August, 1928

Record of Daily, Highest, Lowest and Average Prices and the Customs Duties

	1	2	3	6	7	8	9	10	13	14	15	16	17
Copper c/lb. Duty Free													
Lake (Delivered)	14.875	14.875	14.875	14.875	14.875	14.875	14.875	14.875	14.875	14.875	14.875	14.875	14.875
Electrolytic (f. a. s. N. Y.)	114.75	14.75	14.75	14.75	14.75	14.75	14.75	14.75	14.75	14.75	14.75	14.75	14.75
Casting (f. o. b. N. Y.)	14.35	14.35	14.35	14.35	14.35	14.35	14.35	14.35	14.35	14.35	14.35	14.35	14.35
Zinc (f. o. b. St. L.) c/lb. Duty 1¾c/lb.													
Prime Western	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25
Brass Special	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40
Tin (f. o. b. N. Y.) c/lb. Duty Free													
Straits	48.125	47.75	47.875	48.125	47.875	48.25	48,875	48.875	48.25	48.25	48.25	48.375	48.375
Pig 99%	47.125	46.75	46.75	47.00	46.875	47.25	47.50	47.50	47.00	46.875	46.875	47.125	47.125
Lead (f. o. b. St. L.) c/lb. Duty 2⅛c/lb.	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Aluminum c/lb. Duty 5c/lb.	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30
Nickel c/lb. Duty 3c/lb													
Ingot	35	35	35	35	35	35	35	35	35	35	35	35	35
Shot	36	36	36	36	36	36	36	36	36	36	36	36	36
Electrolytic	37	37	37	37	37	37	37	37	37	37	37	37	37
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	9.875	9.875	9.875	9.875	9.875	9.875	10.00	9.875	9.875	10	10.50	10.375	10.25
Silver c/oz. Troy Duty Free	59.25	59.25	57.125	58.75	58.75	59	59.25	59.125	59	58.875	58.875	59.125	59.125
Platinum $/oz. Troy Duty Free	76	76	76	76	76	76	76	76	76	76	76	76	75

	20	21	22	23	24	27	28	29	30	31	High	Low	Aver.
Copper c/lb. Duty Free													
Lake (Delivered)	14.875	14.875	14.875	14.875	14.875	14.875	14.875	14.875	14.875	14.875	14.875	14.875	14.875
Electrolytic (f. a. s. N. Y.)	14.75	14.75	14.75	14.75	14.75	14.75	14.75	14.75	14.75	14.75	14.75	14.75	14.75
Casting (f. o. b. N. Y.)	14.35	14.35	14.35	14.35	14.35	14.35	14.35	14.35	14.35	14.35	14.35	14.35	14.35
Zinc (f. o. b. St. L.) c/lb. Duty 1¾c/lb.													
Prime Western	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25
Brass Special	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40	6.40
Tin (f. o. b. N. Y.) c/lb. Duty Free													
Straits	47.875	47.75	48.00	48	47.875	47.25	47.625	47.875	48.125	48.25	48.875	47.25	48.082
Pig 99%	46.75	46.625	46.875	46.75	46.125	45.75	46.125	46.50	46.75	47.00	47.50	45.75	46.826
Lead (f. o. b. St. L.) c/lb. Duty 2⅛c/lb.	6.00	6.00	6.05	6.10	6.15	6.225	6.225	6.225	6.225	6.225	6.225	6.00	6.062
Aluminum c/lb. Duty 5c/lb.	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30	24.30
Nickel c/lb. Duty 3c/lb													
Ingot	35	35	35	35	35	35	35	35	35	35	35	35	35
Shot	36	36	36	36	36	36	36	36	36	36	36	36	36
Electrolytic	37	37	37	37	37	37	37	37	37	37	37	37	37
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	10.25	10.375	10.375	10.375	10.375	10.375	10.125	10.125	10.125	10.125	10.50	9.875	10.120
Silver c/oz. Troy Duty Free	59	58.875	59	58.875	58.625	58.50	58.50	58.75	58.625	58.375	59.25	57.125	58.810
Platinum $/oz. Troy Duty Free	76	76	76	75	75	75	75	75	75	75	76	75	75.696

Metal Prices, September 4, 1928

NEW METAL

Copper: Lake, 14.87½. Electrolytic, 14.75. Casting, 14.35.
Zinc: Prime Western, 6.25. Brass Special, 6.40.
Tin: Straits, 48.00. Pig, 99%, 47.00.
Lead: 6.25. **Aluminum**, 24.30. **Antimony**, 10.125.

Nickel: Ingot, 35. Shot, 36. Elec., 37. Pellets, 40.
Quicksilver: flask, 75 lbs., $128. **Bismuth**, $1.70.
Cadmium, 80. **Cobalt**, 97%, $2.60. **Silver**, oz., Troy, 58.25.
Gold: oz., Troy, $20.67. **Platinum**, oz., Troy, $75.

INGOT METALS AND ALLOYS

Brass Ingots, Yellow	10 to11¼
Brass Ingots Red	12 to13½
Bronze Ingots	12½to16
Casting Aluminum Alloys	21 to24
Manganese Bronze Castings	24 to40
Manganese Bronze Ingots	12½to16½
Manganese Bronze Forging	32 to42
Manganese Copper, 30%	25 to35
Monel Metal Shot	28
Monel Metal Blocks	28
Parsons Manganese Bronze Ingots	16½to19¾
Phosphor Bronze	14 to16
Phosphor Copper, guaranteed 15%	18 to21
Phosphor Copper, guaranteed 10%	17 to20
Phosphor Tin, no guarantee	60 to70
Silicon Copper, 10%, according to quantity	28 to32

OLD METALS

Buying Prices		Selling Prices
12¼to12¾	Heavy Cut Copper	13¾to14
12 to12½	Copper Wire	13 to13¼
10 to10½	Light Copper	11¾to12¼
10 to10¼	Heavy Machine Composition	11 to11½
7¾to 8	Heavy Brass	9¼to 9½
6½to 6¾	Light Brass	8 to 8¼
7¾to 8	No. 1 Yellow Brass Turnings	9¼to 9¾
9¼to 9½	No. 1 Composition Turnings	10¾to11
5½to 5¾	Heavy Lead	6¾to 7
3½to 3¾	Zinc Scrap	4¾to 5¼
8 to10	Scrap Aluminum Turnings	12½to14¼
13 to13½	Scrap Aluminum, cast alloyed	17½to18½
19 to20	Scrap Aluminum, sheet (new)	22 to22½
35 to37	No. 1 Pewter	41½to43½
11½	Old Nickel Anodes	13½
17½	Old Nickel	19½

Wrought Metals and Alloys

COPPER SHEETS

Mill shipment (hot rolled	23½c. to 24½c. net base
From stock	24½c. to 25½c. net base

BARE COPPER WIRE

16⅛c. to 16⅝c., net base, in carload lots.

COPPER SEAMLESS TUBING

25c. to 26c. net base.

SOLDERING COPPERS

300 lbs. and over in one order	22c. net base
100 lbs. to 200 lbs. in one order	22½c. net base

ZINC SHEET

Duty sheet, 15%	Cents per lb.
Carload lots, standard sizes and gauges, at mill, less 8 per cent discount	9.25 net base
Casks, jobbers' price	9.75 net base
Open casks, jobbers' price	10.25 to 10.50 net base

ALUMINUM SHEET AND COIL

Aluminum sheet, 18 ga., base price, ton lots	33.30c.
Aluminum coils, 24 ga., base price, ton lots	31.00c.

ROLLED NICKEL SHEET AND ROD

Net Base Prices

Cold Drawn Rods	53c.	Cold Rolled Sheet	60c.
Hot Rolled Rods	45c.	Full Finished Sheet	52c.

BLOCK TIN SHEET

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more 10½c. over Pig Tin; 50 to 100 lbs., 15c. over; 25 to 50 lbs., 17c. over; less than 25 lbs., 25c. over.

SILVER SHEET

Rolled sterling silver 60¾c. to 62¾c. per ounce, Troy.

BRASS MATERIAL—MILL SHIPMENTS

In effect May 25, 1928
To customers who buy 5,000 lbs. or more in one order.

	Net base per lb.		
	High Brass	Low Brass	Bronze
Sheet	$0.19¼	$0.20¾	$0.22¾
Wire	.19¾	.21¼	.23¼
Rod	.17	.21½	.23½
Brazed tubing	.27¼	.....	.32½
Open seam tubing	.27¼	.....	.32½
Angles and channels	.30¼	.....	.35½

For less than 5,000 lbs. add 1c. per lb. to above prices.

BRASS SEAMLESS TUBING

24½c. to 25⅛c. net base.

TOBIN BRONZE AND MUNTZ METAL

Tobin Bronze Rod	21¼c. net base
Muntz or Yellow Metal Sheathing (14"x48")	19¼c. net base
Muntz or Yellow Rectangular sheet other Sheathing	20¼c. net base
Muntz or Yellow Metal Rod	17¼c. net base

Above are for 100 lbs. or more in one order.

NICKEL SILVER (NICKELENE)

Net Base Prices

Grade "A" Sheet Metal		Wire and Rod	
10% Quality	27 c.	10% Quality	30 c.
15% Quality	28½c.	15% Quality	33¼c.
18% Quality	29¾c.	18% Quality	37 c.

MONEL METAL, SHEET AND ROD

Hot Rolled Rods (base)	35	Full Finished Sheets (base)	42
Cold Drawn Rods (base)	40	Cold Rolled Sheets (base)	50

BRITANNIA METAL SHEET

No. 1 Britannia—18" wide or less, No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 8c. over N. Y. tin price; 100 lbs. to 500 lbs., 10c. over; 50 to 100 lbs., 15c. over; 25 to 50 lbs., 20c. over; less than 25 lbs. 25c. over. Prices f. o. b. mill.

Supply Prices, September 4, 1928

ANODES

Copper:	Cast	21¾c. per lb.
	Rolled, oval	21⅜c. per lb.
	Rolled, sheets, trimmed	22⅝c. per lb.
Brass:	Cast	22¾c. per lb.
Zinc:	Cast	12 c. per lb.
Nickel:	90-92%	45c. per lb.
	95-97%	47c. per lb.
	99%	49c. per lb.

Silver: Rolled silver anodes .999 fine are quoted from 62¾ to 64¾c., Troy ounce, depending upon quantity.

FELT POLISHING WHEELS WHITE SPANISH

Diameter	Thickness	Under 100 lbs.	100 to 200 lbs.	Over 200 lbs.
10-12-14 & 16"	1" to 3"	$3.00/lb.	$2.75/lb.	$2.65/lb.
6-8 & Over 16	1 to 3	3.10	2.85	2.75
6 to 24	Under ½	4.25	4.00	3.90
6 to 24	½ to 1	4.00	3.75	3.65
6 to 24	Over 3	3.40	3.15	3.05
4 up to 6	¼ to 3	4.85	4.85	4.85
4 up to 6	Over 3	5.25	5.25	5.25
Under 4	¼ to 3	5.45	5.45	5.45
Under 4	Over 3	5.85	5.85	5.85

Grey Mexican Wheel deduct 10c per lb. from White Spanish prices.

COTTON BUFFS

Full Disc Open buffs, per 100 sections.

12" 20 ply 64/68 Unbleached	$31.00
14" 20 ply 64/68 Unbleached	39.95
12" 20 ply 80/92 Unbleached	33.05
14" 20 ply 80/92 Unbleached	44.80
12" 20 ply 84/92 Unbleached	42.50
14" 20 ply 84/92 Unbleached	57.60
12" 20 ply 80/84 Unbleached	38.35
14" 20 ply 80/84 Unbleached	52.00
Sewed Pieced Buffs, per lb., bleached	45-70c.

CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone	lb.	.12-.17
Acid—Boric (Boracic) Crystals	lb.	.08½
Chromic, 75 and 125 lb. drums	lb.	.21-.22
Hydrochloric (Muriatic) Tech., 20°, Carboys	lb.	.02
Hydrochloric, C. P., 20 deg., carboys	lb.	.06
Hydrofluoric, 30%, bbls	lb.	.08
Nitric, 36 deg., carboys	lb.	.06
Nitric, 42 deg., carboys	lb.	.07
Sulphuric, 66 deg., carboys	lb.	.02
Alcohol—Butyl	lb.	.17¾-.22¼
Denatured, drums	gal.	.45-.53
Alum—Lump, Barrels	lb.	.03¼
Powdered, Barrels	lb.	.039
Aluminum sulphate, commercial tech	lb.	.02⅜
Aluminum chloride, solution in carboys	lb.	.06½
Ammonium—Sulphate, tech., bbls	lb.	.03¾
Sulhpocyanide	lb.	.65
Arsenic, white, kegs	lb.	.05
Asphaltum	lb.	.35
Benzol, pure	gal.	.60
Borax Crystals (Sodium Biborate), bbls	lb.	.04½
Calcium Carbonate (Precipitated Chalk)	lb.	.04
Carbon Bisulphide, Drums	lb.	.06
Chrome Green, bbls.	lb.	.28
Chromic Sulphate	lb.	.37
Copper—Acetate (Verdigris)	lb.	.23
Carbonate, bbls.	lb.	.16-.17
Cyanide (100 lb. kegs)	lb.	.50
Sulphate, bbls.	lb.	.06
Cream of Tartar Crystals (Potassium Bitartrate)	lb.	.27
Crocus	lb.	.15
Dextrin	lb.	.05-.08
Emery Flour	lb.	.06
Flint, powdered	ton	$30.00
Fluor-spar (Calcic fluoride)	ton	$70.00
Fusel Oil	gal.	$4.45
Gold Chloride	oz.	$14.00
Gum—Sandarac	lb.	.26
Shellac	lb.	.59-.61
Iron Sulphate (Copperas), bbl.	lb.	.01½
Lead Acetate (Sugar of Lead)	lb.	.13¼
Yellow Oxide (Litharge)	lb.	.12½
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.58
Nickel—Carbonate, dry, bbls.	lb.	.29
Chloride, bbls.	lb.	.18
Salts, single, 300 lb. bbls.	lb.	.10½
Salts, double, 425 lb. bbls.	lb.	.10
Paraffin	lb.	.05-.06
Phosphorus—Duty free, according to quantity	lb.	.35-.40
Potash, Caustic Electrolytic 88-92% broken, drums	lb.	.09
Potassium Bichromate, casks (crystals)	lb.	.09
Carbonate, 96-98%	lb.	.06¾-.07
Cyanide, 165 lb. cases, 94-96%	lb.	.57½
Pumice, ground, bbls.	lb.	.02½
Quartz, powdered	ton	$30.00
Rosin, bbls.	lb.	.04½
Rouge, nickel, 100 lb. lots	lb.	.25
Silver and Gold	lb.	.65
Sal Ammoniac (Ammonium Chloride) in casks	lb.	.05½
Silver Chloride, dry, 100 oz. lots	oz.	.49½-.54¼
Cyanide (fluctuating)	oz.	.57-.66
Nitrate, 100 ounce lots	oz.	.42¾-.51½
Soda Ash, 58%, bbls.	lb.	.02½
Sodium—Cyanide, 96 to 98%, 100 lbs.	lb.	.19
Hyposulphite, kegs	lb.	.04
Nitrate, tech., bbls.	lb.	.04¾
Phosphate, tech., bbls.	lb.	.03¾
Silicate (Water Glass), bbls.	lb.	.02
Sulpho Cyanide	lb.	.32½
Sulphur (Brimstone), bbls.	lb.	.02
Tin Chloride, 100 lb. kegs	lb.	.37-.38
Tripoli, Powdered	lb.	.03
Wax—Bees, white, ref. bleached	lb.	.60
Yellow, No. 1	lb.	.45
Whiting, Bolted	lb.	.02½-.06
Zinc, Carbonate, bbls.	lb.	.11
Chloride, casks	lb.	.06¼
Cyanide (100 lb. kegs)	lb.	.41
Sulphate, bbls.	lb.	.03¼